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FLIGHT

and The AIRCRAFT ENGINEER

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SEPTEMBER 17th, 1942

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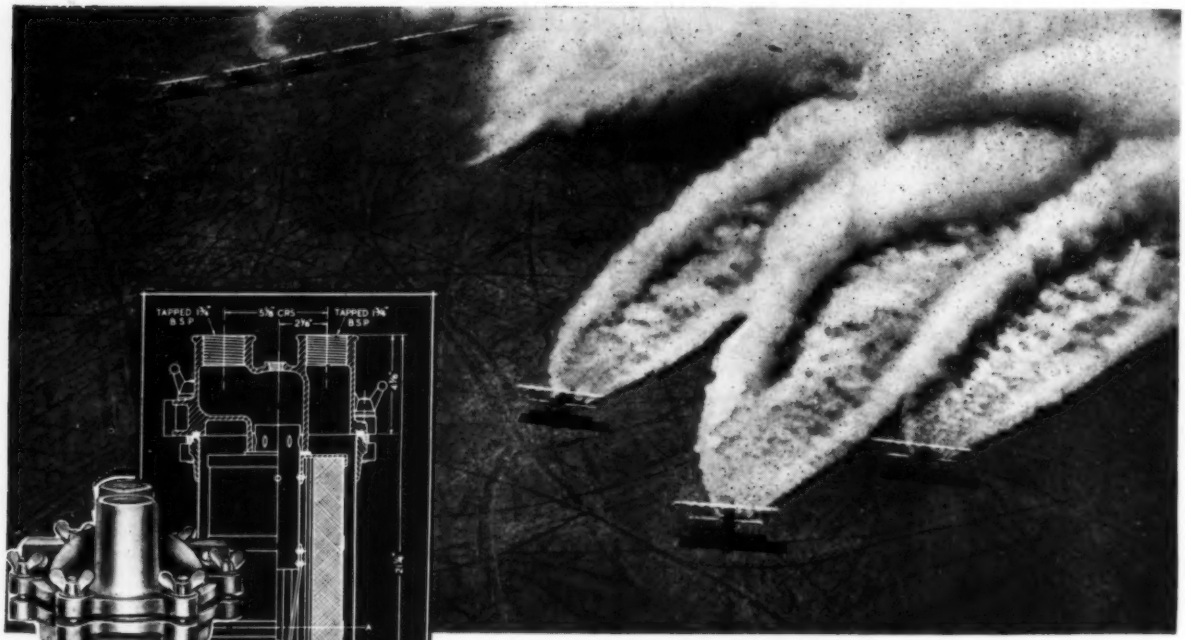
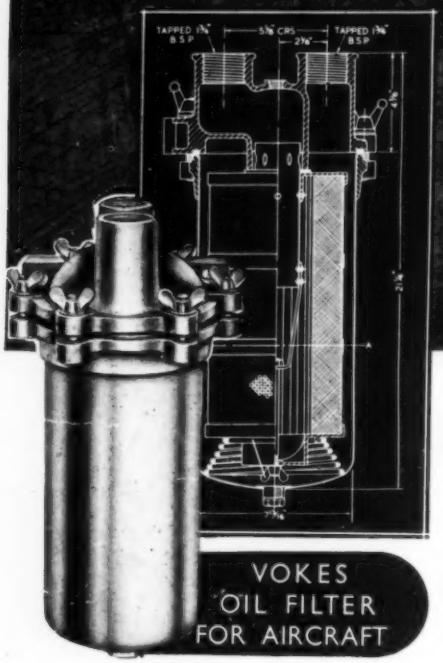


Actual photo of machines taking off in cloud of dust (Syria).



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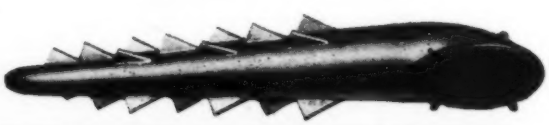

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FLIGHT and The AIRCRAFT ENGINEER

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The Outlook

Carriers in Combination

IN the review of the war which the Prime Minister gave to the House of Commons on September 8th, the air naturally came in for a lot of attention. Nobody in the country gives greater weight to its importance than does Mr. Churchill. Four points dealing with air matters stand out in his speech, and some of them must have been novel to his hearers in the House of Commons as well as to the public in general.

First and foremost among these comes the recent convoy battle in the Mediterranean. A new feature of such operations, he said, was the work of three aircraft carriers trained to work in combination. Much store was set on this combination, and Mr. Churchill said that he had always thought it a matter of the highest importance. The combination was affected at the outset by the loss of H.M.S. *Eagle*, but none the less, the episode was held by the Prime Minister to prove the value of carriers working in combination.

Mr. Churchill also pointed out (what was mentioned by *Flight* at the time, but may not have been generally grasped) that a remarkable feature of the fight was the defeat of the enemy's shore-based aircraft by the fighters from our carriers and the guns of the ships. The Axis has so often boasted that shore-based aircraft could rule the Mediterranean that many have come to regard it as a governing principle. When Italy was preparing for war, she based her strategy on controlling the Mediterranean in that way and decided not to build carriers. Admiral Cunningham, in a recent statement, seemed to agree with that theory, and his opinions are always heard with respect. None the less, in this battle the shore-based aircraft were defeated, and of our naval losses (not counting those of merchant ships, which have not been published) only one destroyer fell to air attack.

The main credit for the air victory was due to the fighters from the British carriers, and it was fortunate that the bulk of them were of such formidable types as Hurricanes and Martlets, though some Fulmars were also engaged in the combats. The A.A. guns on the ships put up the second-best score, with 17 enemy machines shot down, and there is no record of how many attacks were driven away by the accurate gunfire. The R.A.F. Spitfires which had previously been flown off carriers to Malta completed the business, and Mr. Churchill credited them with 16 victories, though the original official figure had only granted them ten. It is clear from the Prime Minister's summary that the days of the carrier in such confined waters as the Mediterranean are not yet over, and the idea that land-based bombers are irresistible cannot yet be accepted. This goes to confirm the view expressed in *Flight* that at the battle of Midway Island the Japanese Admiral, with a number of carriers at his command, must have shown considerable incapacity or lack of resolution in not being able to force his battle fleet to within gun range of the American cruisers, in spite of air attacks from shore bases. His carriers had not been trained to work in combination. Such tactics are an invention of the Royal Navy; the Japanese never initiate anything.

Other points to note in Mr. Churchill's review are that in Egypt three-quarters of the Air Force which has worked so well are from the United Kingdom; that the general opinion in the desert is that low-flying bombers and fighter-bombers are more effectual than Stukas; and that the newly formed Command of the Tenth Army in Iraq and Persia will need to be provided with a substantial air force. This last means a further call upon our supplies and a postponement of the day when Bomber Command will get all the squadrons which it would like to have.

Combined Communiqués

IT is satisfactory to see that some communiqués have been issued jointly by the Air Ministry and the Headquarters of the U.S. Army in the European Theatre of Operations. It is a practice which could with advantage be extended. In the Middle East the doings of the Army and the Air Force are now so closely connected that communiqués dealing with the combined work of the two are the rule. In the same way, when Admiral Lord Louis Mountbatten raids Dieppe or some other place, the story is told in a communiqué from Combined Headquarters. Likewise in the South-West Pacific General MacArthur issues communiqués dealing with all the forces under his command, air and land, American and Australian. In the air offensive against Germany in the West, where the U.S. Army Air Forces and the R.A.F. (including Dominion and European Allied Air Forces) work together, combined communiqués might advantageously become the regular thing. Exceptions would naturally be made to the rule when the time comes for American squadrons to make raids deep into German territory, but while Fighter Command usually provides an escort for them, the whole story of what happened can only be told if both authorities collaborate in telling it.

TRAVELLING BALLOON BARRAGE : R.A.F. Balloon Command co-operate with the Royal Navy in escorting coastwise shipping convoys. R.A.F. personnel work in the balloon ships.

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The Diving Hurricane

LISTENERS were probably astonished to hear a squadron leader state in a broadcast last Saturday that Hurricanes had been used to dive-bomb a factory at Calais. From about 8,000ft. the eight machines were, he said, put into a 70-deg. dive, kept formation all the way down to 1,500ft., dropped their bombs, and pulled out.

There is no gainsaying the fact that the Hurricane can "take it." Designed seven years ago for a Merlin engine of much lower power than the present versions, it has seen all manner of service in addition to its legitimate function. It has had bombs hung on its wings, first light and then heavier ones; it has been fitted with attachment points to enable it to be catapulted from convoys; it has had heavier and heavier armament installed, and now it has been used as a dive-bomber, although that occasion was probably an impromptu affair rather than yet another function.

It may be recalled that an early Hurricane was dived *vertically* at Evere during the Brussels aero show in 1939 by one of Hawker's test pilots, Flt. Lt. R. C. Reynell.

—Ad Astra

"IT is known that Germany did a lot of research work on pressure cabins before the war. We should look rather silly if she quietly got together a couple of dozen high-flying bombers and sent them over London at some 35,000-40,000ft. Neither the present fighters nor the anti-aircraft guns would be able to take toll of them, and no great number would be required to make a daily raid."

That sentence is taken from the leader page of our issue of January 11th, 1940. When we wrote it we did not expect Germany to bomb the British Isles immediately from the stratosphere, but we did foresee that the high-flying bomber was a weapon which Germany was not likely to overlook. Our forecast appears to have been proved correct, in that a type of enemy bomber, said to be a Junkers Ju.86 P, has been reported over this country, flying at a height of about 40,000ft. The 86 is, in itself, an old twin-engined type, but presumably the new version has been fitted with pressure cabin. The original type was produced both with radial petrol engines and with diesels, and it may well be that the new sub-stratosphere type has compression-ignition engines, quite possibly blown by exhaust-driven superchargers. If that be the case, this will be the first time that diesel engines have been employed on operational duties in this war.

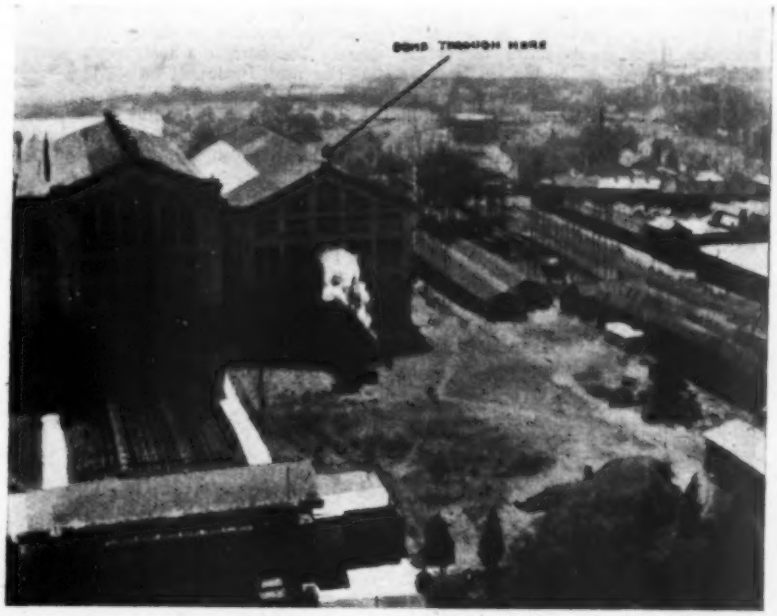
The end of a Ju 87 which fell in " no-man's-land " at El Alamein. The pilot baled out and was captured.

War in the Air

German Reactions to Bombing : Japanese Advance in Papua : The Whirlwind Bomber

THE fine weather with which September has opened has given Bomber Command a chance which has been eagerly taken. Strong forces have raided regularly and Duisburg and Frankfurt were the first important places to suffer since the last issue of *Flight* went to press. The air crews reported that the number of searchlight and A.A. guns has been increased wherever they have flown. The crews, of course, do not appreciate this, but it shows that the Germans are being stirred up by the persistent attentions of Bomber Command, and feel that they must do something about it. The lights and guns must have come from somewhere (or, alternatively, if they are new products of the factories, they would have gone somewhere else but for this new policy) and one way or another the efforts of Bomber Command have done something to ease the pressure on the Russians.

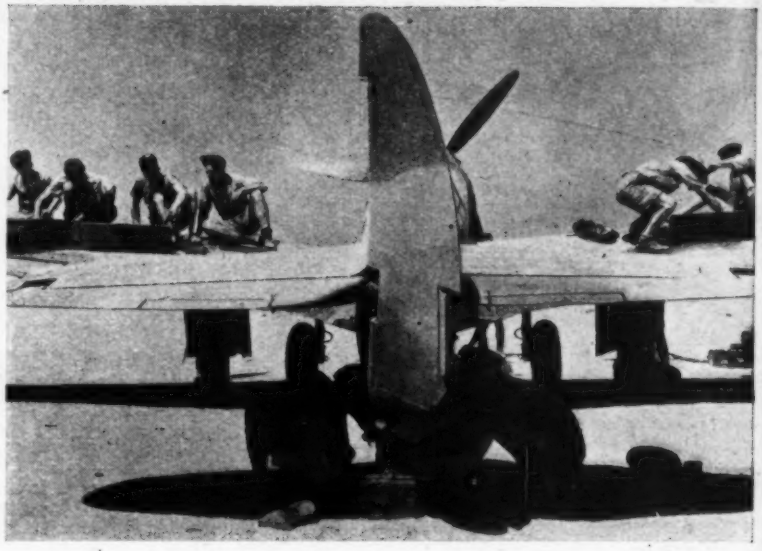
There are also clear signs that the Nazi party is getting nervous about the *moral* of the civil population in Germany. They have not yet permitted any mention of the U.S. Army Air Force conducting raids from Britain. Also they continue to send



SWITCHES OFF ! A photograph taken during a raid by Bostons of a direct hit on the switch house of Comines power station, the bomb went through the roof and the smoke in the foreground indicates a burst on the lower floor.

WAR IN THE AIR

their own bombers by ones and twos over Great Britain, telling their own people that these have been destructive raids. To this policy may be attributed a few "Alerts" which have been heard recently in the London area by day and night. We must conclude that if and when the Germans can spare a substantial force of bombers from other fronts during the winter they will attempt something more ambitious against Great Britain. We must all be prepared for that, and show a stiff upper lip. Because we have had some eighteen months of quiet, we must not imagine that all our tribulations are things of the past. If the British people were to get that idea into their heads, and then a heavy raid were to come, the disappointment might cause a shock and a lowering of the national *moral*. It is wiser to be prepared for the worst, but not to let it worry the mind. Göring may not be able to spare a large force from all the other fronts, even in the winter.



FOR "SOFT" VEHICLES: Rearming the 0.5in. guns of a Kittyhawk fighter-bomber in the Western Desert. These have done great work recently in shooting up Rommel's transport.

Danger in Papua

THINGS have taken a turn for the worse in New Guinea, where the Japanese have reached the important pass on the summit of the Owen Stanley range and have outflanked the Australians there. The fighting has been stiff, with many casualties on both sides. In that jungle country the Japanese need a minimum of supplies, and, therefore, air bombing of their lengthened line of communications is less effective than it would be over a different terrain. The infantry who fight in the jungle, often carrying food for a week, must be pretty well immune from air attack. Nevertheless the bombers of the United Nations have been industriously at work. Every effort will be made to hold Port Moresby.

The fighting on all the Russian fronts has continued at a furious rate, and everywhere both sides have used their aircraft to the utmost. Round Stalingrad both Russian and German bombers have been attacking the supplies and communications of the other, and each front is now far from its main centres of supply. In various sectors Stormoviks have driven the German troops back. In the fighting for the naval base of Novorossiisk aircraft of the Red Fleet have been successful in preventing German landings from the sea. The Germans say that they have bombed Astrakhan, at the mouth of the Volga on the Caspian Sea. The Russians have again raided Berlin and Budapest as well as East Prussia.

These long raids by the Russians are fine exploits. One admires the spirit which can indulge in attacks of that nature while such immense battles are in progress, and also the navigation which takes the bombers right over such distant targets. The main object of most of these raids must be to interfere with German lines of supply.

A New Fighter-bomber

SEPTEMBER 9th saw a new weapon of war in use, namely the Westland Whirlwind two-engined fighter in the rôle of a fighter-bomber. Racks have been fitted to carry two bombs outboard of the engines. The new type's bow was made to the world when two sections of Whirlwinds, escorted by Spitfires, attacked four armed trawlers which were steaming from Cap de la Hague, near Cherbour, towards Alderney. Two of the trawlers were sunk by the bombs.

Another recent novelty in the tactics

READY FOR EVENTIDE: A scene on a Lancaster station where a number of these bombers are being prepared for the night's work.

ENEMY AIR LOSSES TO SEPT. 12th.

	Over G.B.	Over Continent	Middle East
Sept. 6	0	0	0
" 7	1	12	9
" 8	2	1	4
" 9	0	0	3
" 10	0	1	0
" 11	0	2	4
" 12	0	0	5
	3	16	25

Totals: West, 6,331; Middle East, over 4,545. R.A.F. and American successes are counted together.

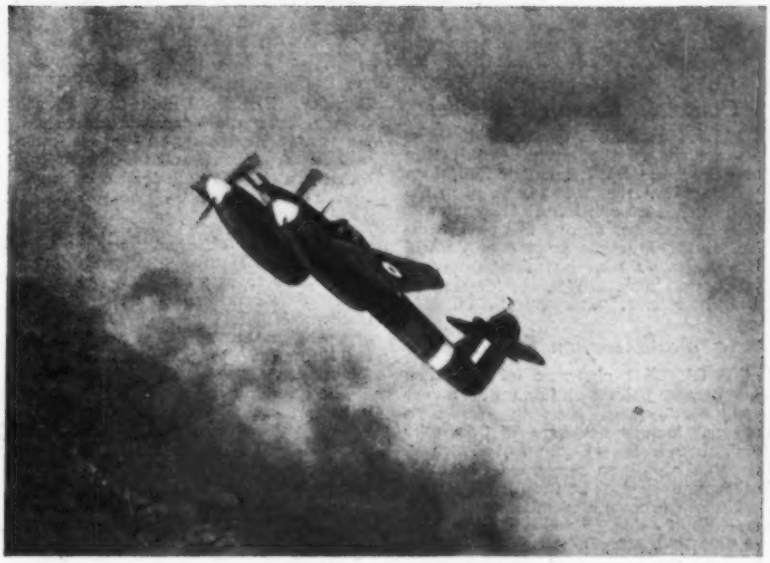
of Bomber Command is sending out single bombers in daytime to attack places in Germany. Emden and other places were attacked in that way early in the morning of September 7th, and no loss was suffered by the bombers. The defences were probably taken by surprise.

In Egypt a lull followed the withdrawal of the Afrika Corps from its attempt to break through to Alexandria. The lull, however, affected the ground more than it did the air, though naturally the R.A.F. squadrons eased off a bit from the fury with which they piled sortie on sortie during the heat of the battle. It has been officially stated that during that peak period well over one million lb. of bombs were dropped on the Afrika Corps and Italian advanced elements. As our land forces advanced they found the desert strewn with the wrecks of enemy tanks, motor transport vehicles, and supplies.

Latest News

IT is deplorable to have to record that the Russians have evacuated their naval port of Novorossisk, despite a gallant defence. It is a severe blow to the Russian Black Sea Fleet, which will now have to use bases much farther away from the scene of active operations. This fleet has done yeoman service so far, and now its usefulness will be considerably reduced.

The all-important struggle for Stalingrad has continued with ever-increasing fury, and up to the moment of writing, the intrepid Russians continue to hold their own, though forced back here and there by the weight of the German attack. The losses must be extremely heavy on both sides, but in fighting of that sort it is inevitable that the attackers must lose more than the defenders. The main strength of the *Luftwaffe* has been congregated on this sector of the enormous front, but the Russian soldiers, from all accounts, have got past the stage of being terrified by dive-bombing. Nevertheless, the *Luftwaffe* sometimes blasts a way through.



NOW GIVING THE LOW DOWN: The Westland Whirlwind, originally designed as an interceptor fighter, is now in the news as a fighter-bomber for low attacks.

BRITISH AIR LOSSES TO SEPT. 12th.

	Over G.B. A'crft.	Over Continent B'brs.	Over Continent F'trs.	Middle East A'crft.
Sept. 6	0	8	1	0
" 7	0	0	1	1
" 8	0	10	4	
" 9	0	0	0	11
" 10	0	31	0	
" 11	0	0	1	
" 12	0	0	0	1
	0	49	7	13 (2 pilots safe)

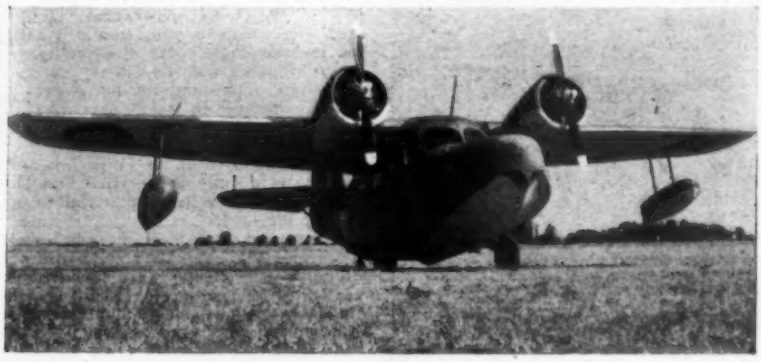
Totals: West, 4,687; Middle East, about 1,672

West of Moscow, General Zhukov continues to press forward in a methodical manner through difficult country, while the Leningrad front has become much more lively. The garrison has been thrusting outwards, and other Russian armies are starting a movement from without to link up with it, and so break the blockade. The winter will soon set in on this northern front, and then again it will be possible to supply Leningrad across the ice of the lakes, as was done last winter. Snow is already reported on the foothills of the Caucasus.

On many other fronts there have been air operations of greater or less significance. Dusseldorf was heavily raided on September 10th by the R.A.F. The heavy bombers of the R.A.F. in India have bombed railway communications at Rangoon and Mandalay. The monsoon should be nearly over in Burma, and further activity may be expected.

British Empire forces have landed at various points on the west coast of Madagascar, and are advancing into the interior. Naval aircraft flew overhead during the landings, and the guns of the fleet were ready to fire if necessary, but as the French artillery remained silent the Royal Navy did likewise. General Platt (of Abyssinia fame) is in command there, and his object is to stop all pro-Axis activities in the island without hurting more French soldiers than is absolutely necessary.

In Egypt General Alexander must either be waiting for more reinforcements or else wants to provoke Rommel into making another attack. So, for some days, aircraft and artillery monopolised the fighting.



GRUMMAN GOOSE: The Grumman G.21A amphibian wearing R.A.F. colours. The Goose is powered by two 450 h.p. Pratt and Whitney Wasp engines. Span, 49ft.; length, 38ft. 4in.; height, 13ft. 11in.; max. speed, 200 m.p.h.; wing loading, 21.3 lb./sq. ft.; power loading, 8.9 lb./h.p.

HERE AND THERE

Canada's Aircraft Controller

RALPH P. BELL, Canadian director-general of the aircraft production branch of the Department of Munitions and Supply, Ottawa, has been given the additional post of Aircraft Controller.

In his new position he will be a member of the Wartime Industries Control Board and will have jurisdiction over all production facilities for the making of aircraft, aircraft parts and gliders.

Radiolocation Expert

APPOINTED chairman of the then new Radiolocation Committee a year ago, Sir Robert Renwick has been selected for the new post of Controller of Communications Equipment at M.A.P. and has also been appointed Controller of Communications at the Air Ministry.

He will become a member of the Aircraft Supply Council and will be assisted at M.A.P. by Sir Robert Watson Watt, who was responsible for the initial experiments in radiolocation, and who will continue to hold the position of Scientific Advisor on Telecommunications.

Air Mail to South America

THE Postmaster-General has drawn attention to the correct air mail postage rates for correspondence for South America, about which some misapprehension seems to exist. The collection of surcharges on underpaid correspondence has given rise to complaint.

Air mail letters for the Argentine, Bolivia, Brazil, Chile, Paraguay and Uruguay, intended for transmission by air throughout, should be prepaid at the rate of 3s. 6d. per ½oz. (postcards 1s. 7d.), and should be superscribed "North Atlantic Air Service."

Air mail letters for the same destinations intended for conveyance by sea to New York and thence by air should be prepaid at the rate of 2s. 3d. per ½oz. (postcards 1s.) and should be superscribed "via New York."

The corresponding rates for Colombia, Ecuador, British, Dutch and French Guiana, Peru and Venezuela are 2s. 9d. per ½oz. (postcards 1s. 4d.) for air transmission throughout, and 1s. 6d. per ½oz. (postcards 9d.) for conveyance by sea to New York and thence by air.

Aircraft Workers' Playtime

SPONSORED by generous donors anxious to help brighten the leisure time of aircraft and other factory workers, Mobile Cinema Services, Ltd., of Surbiton, are now able to offer free entertainment programmes for such factories.

The company has a number of mobile units presenting shows mainly to the Services throughout the country, and will gladly fit factory visits into their itineraries whenever possible; applications will be dealt with in strict rotation.

Non-inflammable 16 m.m. films are used, and well-known stars are featured in their programmes.

Aircraft Recognition

PRINTED on cards, eyeletted and corded for hanging, approximately 22½ × 14½in., identification charts are available from these offices of the leading types of British, American and German aircraft, at 1s. 3d. each net. Postage on single copy, 6d. extra.

Prepared by the staff of *Flight*, these charts embody head-on, broadside and underside aspects of the aircraft depicted and indicate their leading characteristics. Thousands are in use all over the country. On three copies postage is 7d. extra, on six copies 8d. extra, on twelve copies 11d. extra, and on 36 copies 1s. 1d. extra.

Plans for Cargo Planes

IN an article on "American Air Transport" in last week's issue of *Flight*, we concluded by expressing the opinion that the projected scheme of Henry Kaiser, the high-speed shipbuilder, for large-scale production of big cargo aircraft would certainly be considered.

GOOD SHOW: This special poster, printed in colour, was used recently when the Bristol Aeroplane Coy. organised an "R.A.F. Week," as a result of which they raised more than £1,200 for the R.A.F. Benevolent Fund. Cricket matches, concerts, dances and exhibitions of aircraft, engines and scale models all helped to swell the total.

Now comes the news that Donald Nelson, chief of the U.S. Production Board, has been in conference with Kaiser, and afterwards stated to Press representatives: "We are going to pursue this thing just as rapidly as possible to its logical conclusion."

At the same time Col. Llewellin, British Minister of Aircraft Production, has informed Major Lyons in the House of Commons that a suitable production programme for cargo-carrying aircraft has been arranged and that orders had already been placed in this country.

As our gallant Allies would say, "Now we're getting some place."

Snaps for the Admiralty

THE response of the public to the Admiralty's broadcast request for photographs has been overwhelmingly successful. The organisation originally set up was faced with the prodigious task of dealing with 60,000 replies, and immediate expansion was necessary.

Many people in their eagerness to respond dispatched thousands of photographs at once without even waiting to be called upon to do so. This generous impulse is warmly appreciated and has produced much valuable material covering a wide field.

The original request is confirmed, however, that in the first instance descriptive letters only are preferred so as to avoid the need of sorting and returning to their owners material which is either more than 15 years old or is already in the Admiralty's possession.

Those whose offers of photographs are accepted will hear by letter from the Admiralty, and they are asked to act at once by sending them by means of the franked and addressed label supplied.

ASYMMETRICAL URGE: The Martin B-26 (Marauder to you) demonstrates the value of the fully feathering airscrew, while flying with its starboard "Double Wasp" switched off. Flying on one engine is part of the training of all "twin-engine" pilots and this picture was taken near Barksdale Field, Louisiana.

A FERRY PILOT'S DAY

"Flight" Visits the A.T.A. : How the Day's Work is Planned : Delivery of a Halifax to Bomber Command Provides Typical Example : Bad Weather and a Stray Hun : 100,000 Aircraft Have Now Been Ferried

By N. D. R.

THE Senior Commander of the A.T.A. ferry pool walked into the "Met" office accompanied by a decidedly anxious member of the *Flight* editorial staff; the weather looked far from promising and it seemed doubtful if this was going to provide a fair sample of a day in the life of a ferry pilot. Indeed, the large weather board on the office wall bore the ominous entry, "Cloud 8/10 to 10/10, 400-800ft.; hills covered by mist," which threatened to impose a *day-off* in the life of a ferry pilot.

Tracing light pencil lines on a weather chart of the British Isles, the forecaster gloomily indicated the position of an almost stationary warm front and the slow approach of a cold front from the broad Atlantic.

"Not very hopeful, I'm afraid," said the Senior Commander, who in pre-war days was a celebrated sail-plane pilot and therefore profoundly weather-wise, "but you can never be absolutely certain. At the moment, however, it looks as though to-day's programme will be limited to local work."

The forecaster consulted his data again and made a minor alteration on his weather chart. "It may clear a little towards lunchtime," he said, "but if it does it will almost certainly clamp down again later in the afternoon."

As we were visiting the H.Q. ferry pool of the Air Transport Auxiliary to see just what it meant to be a ferry pilot, we followed the Senior Commander to the operations room with spirits no higher than the barograph reading we had just been shown.

THE CUP THAT CHEERS. A corner of the canteen; needless to say this establishment is "dry," the strongest beverages served being tea and coffee.

A.T.A.'s THIRD BIRTHDAY

THIS month the A.T.A. celebrates its third birthday, and has just ferried its 100,000th aircraft for the R.A.F.

Few wartime organisations have grown so rapidly or attained such vital significance in the prosecution of the war effort as has the Air Transport Auxiliary.

When it was formed in Sept., 1939, by Mr. Gerald d'Erlanger, of British Overseas Airways, it comprised a single pool of some 20 civilian pilots; now it operates 14 pools in various parts of the country and the total of its pilots is numbered in hundreds. From sharing with the R.A.F. at two of their stations the work of ferrying aircraft from factories to maintenance units, it has expanded to the responsible position of handling the whole of inland ferry work and moves more than a hundred aircraft every day, thus releasing as many R.A.F. pilots for operational duties.

To mark the occasion of the 100,000th aircraft delivery, Flight sent a member of its editorial staff to the headquarters' pool of the A.T.A. to see just what a day in the life of a ferry pilot was like, and here are his impressions.

On the table lay the day's programme sheet on which was already entered, in appropriate columns, the list of aircraft to be moved, their present position in various parts of the area served by this particular pool, and their intended destination.

"Fortunately it's a very small programme to-day," observed the Senior Commander, "only 29 machines to move, and even so it looks from the 'Met' report as though we needn't have dragged you here so early in the morning. However, we'll get this programme sheet worked out and hope for the best."

On the end wall of the room, in a series of columns according to their classification, were the names of the pilots available that day. (As previously explained in an article by Group Capt. G. W. Williamson, on A.T.A. organisation in *Flight* of June 18th last, ferry pilots are graded into various classes according to their experience and ability, from those who can as yet only be entrusted with such aircraft as Tiger Moths, Maggies and Fairchilds, up to the Class 5+ pilot who can handle anything that flies. The A.T.A. runs its own schools and conversion courses to improve and progress its pilots, but that is no part of this story.)

Working out the programme sheet was rather like playing patience; the important point being that having sent your pilots out to places scattered all over the country, you have to try to get them all back again before nightfall. Much of this can be accomplished by adroit allocation after a careful study of the delivery routes. Perhaps you can drop Jones, per Anson taxi, at Little Twittering, where he must collect a Wimpy and fly it to Hogs Norton, where a Hurricane awaits delivery to Greater Wallop. Should there be an aircraft at Greater Wallop destined for Nether Backwash on the other side of his home pool, Jones can then come home in it and the machine can complete its trip next morning.

Aerial Patience

If, however, the good people at Greater Wallop have no further business to offer Jones, when he hands over the Hurricane, then it will be arranged for one of the pool's taxi-aircraft to collect him on its way home. Incidentally it is worth noting that the A.T.A. has a conscientious regard for economy and never sends out an Anson if a three-seater Fairchild is big enough for the job in hand.

Watching the Senior Commander work out his game of aerial patience on the programme sheet was extremely interesting. The last of the various columns to be completed is headed D/C—D for Delivered, C for Collected.

"The bigger the programme the better the D/C column

A FERRY PILOT'S DAY

works out" explained the Senior Commander, "but when you have worked it out as far as it will go, using the aircraft listed, you then get out a taxi sheet for collecting those pilots left with a D but no C to their names."

Helpful Addition

It did not take long to work out this particular day's programme and a girl typist was soon busy completing the instruction slips for each individual pilot. While this was in hand, however, the telephone brought an additional job to be included in the day's programme and adjustments were quickly made to fit it in. As often happens in such cases, the additional job proved to be helpful in getting one of the pool's pilots part of his way home and so effected an economy on the taxi sheet.

In the meantime faint signs of improvement in the weather suggested another visit to the "Met" office. At any rate, the drizzle of rain which had ominously begun some time after dawn had eased off appreciably and a study of the latest reports indicated that, a bit later on, it might be possible to make a start.

While waiting to see which way the meteorological cat intended to jump, a visit was paid to the pilots' rooms, one of which had all the attributes of a rather jolly club (except for the bar!) and was known as "the noisy room," the other possessing the restful atmosphere of a library, with its deep leather armchairs and writing tables, and being known as "the quiet room." These, and the canteen and other rooms in the building, were all equipped with loud speakers by which pilots could be summoned to the operations room or given any other urgent message with the minimum delay.

It was at this stage that we were introduced by the Senior Commander to Capt. W., one of the pool's "four-engined" pilots whose job that day would be to collect a Halifax from its birthplace and deliver it to an R.A.F. station about 150 miles away. There was no machine to be moved from this particular R.A.F. station that day; so the Captain, whom we were to accompany, would be picked up by an Anson taxi which would make a detour on its homeward journey for this purpose.

Capt. W. did not think much of the weather, either, explaining that few, if any, of the aircraft handled by A.T.A. pilots had their radio equipment in operation, and that for this and other reasons the ferry pilot was cut off from the help of wireless communication with the ground. Also, regulations demanded they must always fly within sight of the ground, and hedge-hopping with a four-engined bomber in conditions of bad visibility was not to be recommended. Over a cup of tea in the canteen (the strongest beverage served there), Capt. W. mentioned that, in spite of English weather and the fact that no pilot who measured up to R.A.F. requirements in such matters as age and physical fitness could be accepted in the A.T.A., their accident rate was less than one-quarter of one per cent. . . . a figure which even included forced landings involving the most trifling of superficial damage to the aircraft concerned.

Learning by Experience

Capt. W. was typical of the A.T.A. ferry pilots. He had learnt to fly some ten years ago as an ordinary member of a civilian flying club in the West Country, and, not being eligible for the R.A.F., became one of the earliest recruits to the A.T.A. He progressed as he gained practical experience as a ferry pilot, and to-day he can handle anything from a Maggie to a Stirling.

"More than once," he said, "I have had to fly a type which was quite new to me without any dual instruction;

(Above) One of the two pilots' rooms at the headquarters ferry pool, where instructions may be awaited in peace and quiet.

(Left) Routes are checked before starting; all ferry pilots must fly within sight of the ground and fly by the map.

(Right) A party of ferry pilots emplaning in one of the pool's Anson taxis for their various starting points.

a few tips on the machine's characteristics just before I took off was the only introduction I had on such occasions."

In this respect the A.T.A. has in operation a very useful service. It compiles little booklets, known as "Handling Notes," on every type of aircraft with which it deals. These are written in the clearest of phraseology (the compilers have nothing whatever to do with any "Ministry"), and they set forth briefly and lucidly all the practical information needed by a pilot who may be a newcomer to the particular type in question. This information tells the pilot where he will find the less obviously situated controls, such as those for the flaps and undercarriage, and gives him a few essentially practical tips on the actual flying. In the former case, for example, it may say that a certain lever is "to the right of the seat and just below knee level" . . . a perfectly simple direction which anyone could understand, and easy to remember. When it is stated that, even lumping all Wellingtons together as one type, for instance, the A.T.A. handles some 90 different kinds of aircraft, the extent and usefulness of this one department alone can well be imagined—so can the versatility of its ferry pilots.

(Above) Ferry pilots receiving their instructions in the operations room.

(Right) When the ferry pilot returns he makes his report and is checked in on the "score-board."

Making a Start

By this time it was getting on for 10 o'clock, and, although the weather was still far from encouraging, it was decided to make a start. "Better bring your suitcase," said the captain with a grin; "the only time I am sure to get stuck away from home for the night is when I leave my pyjamas behind."

We were joined by a flight-engineer in case the weather allowed delivery of the Halifax, collected our parachutes, and, climbing into a light covered van, were taxied over to where the Anson awaited us at its dispersal point in a far corner.

In the two-minute interval between getting into the van and reaching the Anson it began to rain again. At 10.10 a.m. precisely we were air-borne in a veritable downpour with a visibility of a few hundred yards at most, and Capt. W. levelled off at 400ft., practically scraping the cloud-base. It was only a 15-minute hop to where the Halifax awaited us, so the Anson's wheels were left down; it takes 165 turns on the hand-winding gear to retract or lower them, and in any case speed was definitely not required in the prevailing flying conditions.

One thing has certainly not been

A FERRY PILOT'S DAY

changed by the war; you can still spend as much time as ever waiting on wet airfields when you are proposing to fly without wireless. Sitting in the Anson, whose emergency exit leaked raindrops down the journalistic neck, we waited, what time the captain, from a sense of routine duty rather than hope, presented himself to the Handley Page authorities. He returned later to announce that things did not look very promising, but we would wait for an hour and see if they improved.

We continued to wait, periodically scanning the heavens for some sign of a change. But the only change for some time was that the rain increased, then eased off, then pelted down again. By noon a uniformly leaden sky showed encouraging signs of breaking up a little, and it actually grew a shade brighter; away to the south there was even a hint of whiteness, low on the horizon. We pointed this out to Capt. W., who smiled doubtfully.

"Trouble is," he said, "all this dirty stuff is moving in the direction we want to go; if we were to start now we should only catch it up." He strolled away and disappeared into the factory, but returned in a few minutes with a really sound suggestion.

"It's nearly lunch time, and I've managed to get hold of a taxi; what about it?"

The "Met" Office was Right

This airfield was right on the fringe of a small township and during lunch we noticed that the captain, who sat facing the window of the restaurant, glanced critically over our shoulder from time to time. When the coffee arrived he explained that he had been keeping an eye on the white blind over a shop window on the opposite side of the road. "It's been getting steadily whiter," he said, "so there may be a chance after all."

While the taxi was whisking us back to the airfield the sun almost came out! We reminded the captain that his "Met." office had forecast a lunchtime improvement.

"Looks as though they're right for once," he grinned.

The weather people at the factory airfield reported that conditions were now quite reasonable along our intended route, and, sure enough, men were already pulling the canvas covers off the gun turrets and cockpit of a waiting Halifax. We climbed aboard, the captain took his place in the pilot's seat, the engines were started and run-up, the aileron lock removed from the control column, the usual items checked, and the Halifax was taxied out to the far end of the broad tarmac runway.

Just for experience we decided to view the take-off from the bomb-aimer's position. The well-upholstered tummy and arm rests made the prone position quite comfortable, but as the big bomber gathered speed under the urge of its four Merlins we found it necessary to hang on fairly tightly to avoid being lurched sideways as the lightly loaded aircraft rode the invisible inequalities in the runway. One gets the full impression of speed, both physically and visually, from this position down in the nose.

The landscape having settled down to a leisurely slide, we left the bomb-aimer's position and went aft on a tour of inspection, standing beside the flight-engineer for a few moments to enjoy the comprehensive view from the astrodome. The dorsal turret, we found, was a shade awkward for unpractised hands and feet to enter, but once there the view was admirable. A stroll down the roomy fuselage brought us to a bulkhead door giving access to "tail-end Charlie's" department, and we were at once impressed with the really generous field of fire commanded by this rear turret, which, by the way, has far better leg and elbow room than one might imagine.

Returning to the "office," we installed ourselves in the second pilot's seat beside the captain. Visibility was now quite good, but a low ceiling kept us down to some 700 ft., and the little white blobs of human faces that stared up from fields, streets and back gardens seemed to have a comically surprised air in their foreshortened perspective.

ALL CLEAR! The Anson "taxi driver" about to take off with his passenger pilots.

Your ferry pilot has no skilled navigator to give him his course. Capt. W. had his map on his knees. He indicated our position on his map and we amused ourselves for a while checking up on the progress of the Halifax. Yes, there was that big town and the railway junction and the canal. We glanced at the compass; soon we ought to see the place where two rivers met—yes, here it was—and so on until our destination hove in view.

As we taxied in—and the Halifax taxies like a big, well-sprung motor car—our Anson made a timely arrival overhead so that by the time the simple formalities of handing over the bomber were completed it had trundled up alongside. We re-embarked at once, having in mind that since the A.T.A. "Met" office had been right about the mid-day improvement in the weather, it might also be right about its "clamping down" again later on.

No Time to Waste

The trip in the Halifax, cruising down wind on a fraction of its power at 160 m.p.h., had occupied some 55 minutes. The Anson, flying up-wind at 140-145 m.p.h., would take over the hour to get us back, so if the clear weather was to be only a temporary blessing we had no time to waste if we wanted to avoid having to sleep in strange beds.

Capt. W. took over the Anson controls and set course for home. For the greater part of the journey the weather held, but as we neared our destination we ran into rain and were forced to come down to less than 500ft. Visibility was now shortening considerably and when we were obliged to climb to 1,100ft. to clear a range of low hills in safety, we flew for several minutes with forward visibility at zero.

Remembering the numerous Wimpies, Hurricanes, Harvards and so forth which we had encountered at frequent intervals on the outward trip, we confess to a sense of relief when we suddenly shot out into a comparatively clear sky again. Another ten minutes or so brought the home airfield into sight, and the immediate prospect of tea in the canteen seemed most attractive.

It had been an uneventful day from the ferry pilot's point of view, though one involving loss of time through bad weather, but when we taxied up to the apron, we noticed tin-hatted spotters on the roof of the A.T.A. building, the ambulance and fire-engine at the ready and all hangar doors shut. The "Alert" had sounded about 20 minutes before!

The possibility of encountering a Jerry while he is flying is one of the chances the ferry pilot has to take. "I once did," said Capt. W. with that cheerful grin of his, "but he promptly hared off for all he was worth."

Admittedly daylight raiders are not all that numerous just now, but the A.T.A., which operates 14 ferry pools up and down the country, sends hundreds of pilots into the air every day, so vast and vital has its part in the nation's war effort become. Thus every Jerry who *does* penetrate our coastline in daytime stands quite a good chance of meeting one of these airmen.

Not that the ferry pilots themselves ever worry; like Capt. W., they just grin and carry on with the job.

MORRISONS

CROYDON
PRESTON, TADWORTH
AND PETERBOROUGH

AIRCRAFT CONSTRUCTION AND REPAIR

Fourteenth of the New Recognition Series

AIRCRAFT TYPES AN

Mitchell and Manchester

WITH such a multiplicity of types now in service, and more so now that the U.S. Army Air Forces are operating from this country, any newcomer which brings with it unique characteristics that facilitate recognition must be a popular number with spotters in general and the R.O.C. in particular.

Such a machine is the North American NA-40B, known to the U.S. Army as the B-25C and to the R.A.F. as the Mitchell.

Now it is a recognised fact that, with certain exceptions, the most difficult angle of all from which to make a "snap" identification of an aircraft is from the head-on view. But the Mitchell has one unique feature about its design which is best seen from head-on; its mid-wings have a dihedral angle to the centre-section and a slight but unmistakable anhedral to the outer panels. Put another way, it may be described as a slightly gulled wing, the outer panels of which slope downwards towards the tips. Reference to the illustrations below will show that while this characteristic is barely perceptible from the three-quarter front view shown in the photograph, it is perfectly visible in the "head-on" drawing beneath.

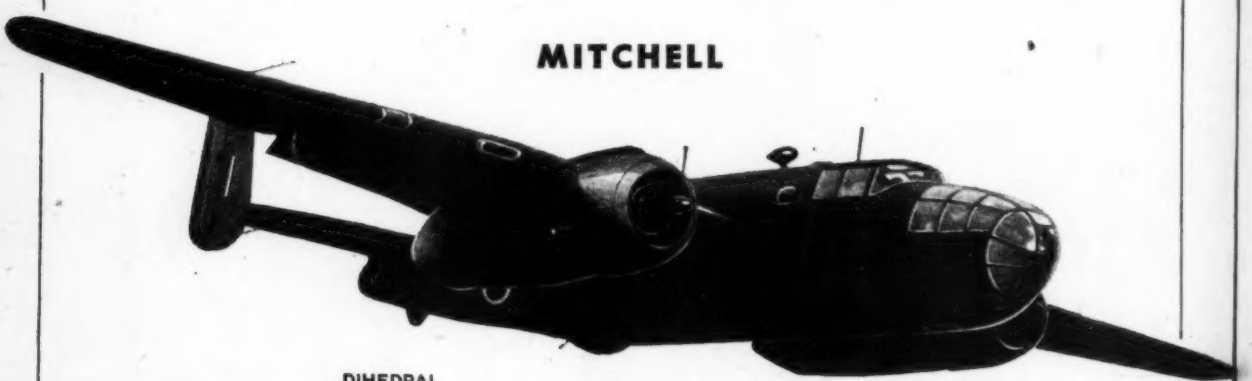
A second important characteristic is most plainly seen when the machine is viewed in plan, namely the abnormally long nose. This is so very long, in fact, that the wings appear to be set approximately half-way back along the fuselage. A long nose is, of course, found on a number of multi-engined aircraft, particularly those which, like the Mitchell, are equipped with a tricycle undercarriage, but in few, if any, is it so very pronounced as in this instance.

Recognition features of lesser importance are the large underslung engine nacelles which extend aft of the trailing-edge, and the angular fins and rudders whose sloping edges give them the appearance of being tilted backwards.

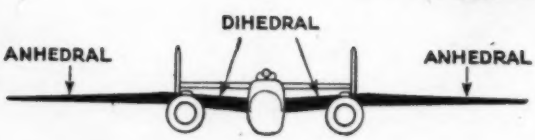
Powered by two Wright Cyclone GR-2600 14-cylinder two-row radial air-cooled engines, the Mitchell has a semi-monocoque fuselage of aluminium alloy covered with the same material, the upper portion between the front spar and the trailing-edge of the wings being integral with the centre-section.

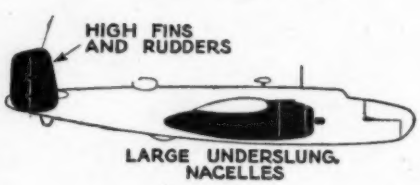
The wings are also of all-metal construction with smooth "Alclad" skin and have removable wing-tips and fuel tanks integral with the centre-section. The wing flaps, which are of the slotted type, are in two sections and are hydraulically operated. De-icing equipment is provided on all leading-edges and on the c.s. airscrews.

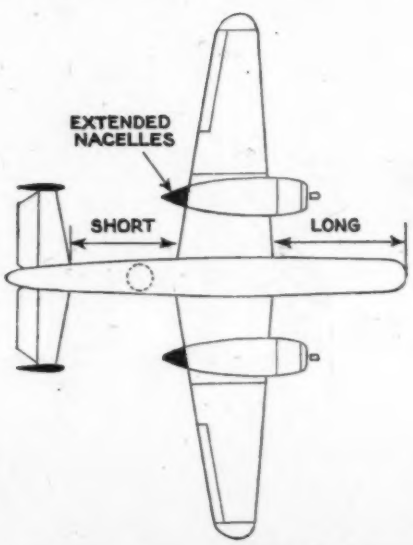
The bomb load is stowed internally beneath the centre-section and the disposable load is quoted at 8,000 lb., which is one-third of the all-up weight of 24,000 lb. No details on performance or armament are available.



MITCHELL







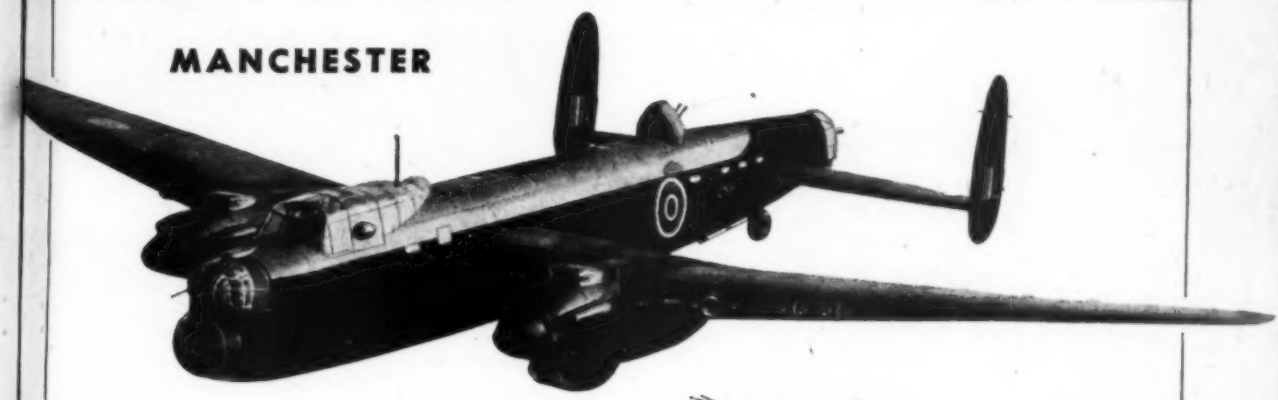
DIMENSIONS

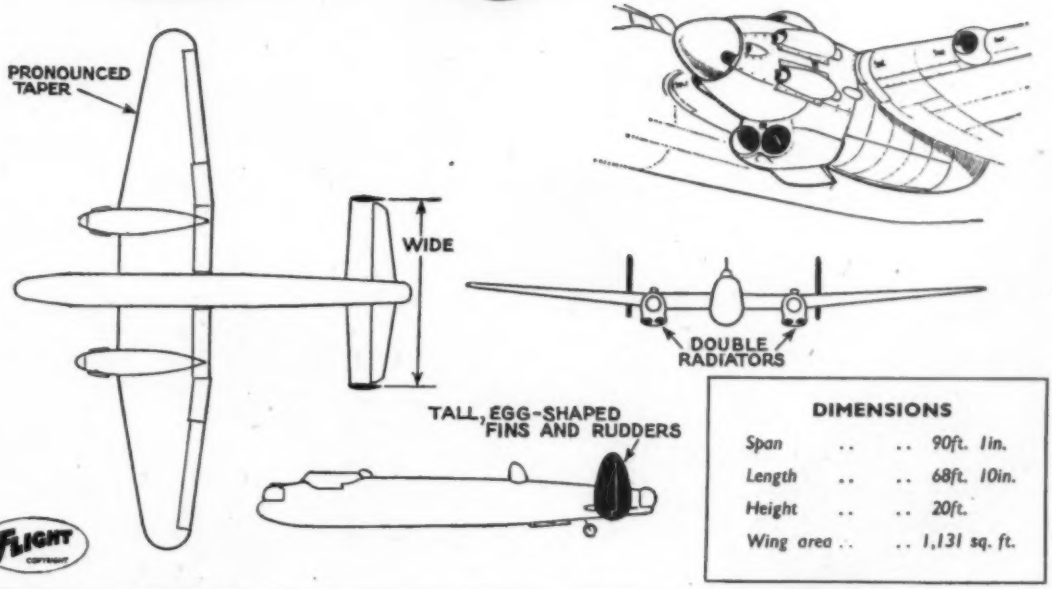
Span	67ft. 7in.
Length	54ft. 1in.
Height	15ft. 10in.
Wing area	610 sq. ft.

FLIGHT COPYRIGHT

THEIR CHARACTERISTICS

MANCHESTER





DIMENSIONS

Span	.. ..	*90ft. 1in.*
Length	.. ..	*68ft. 10in.*
Height	.. ..	*20ft.*
Wing area	.. ..	*1,131 sq. ft.*

WHEN it first made its appearance, the Avro Manchester was fitted with a fixed vertical central fin in addition to the twin fins and rudders outrigged on the tailplane tips, but after a certain number had been produced, this extra fin was abandoned and the areas of the normal fins and rudders increased. The early "triple tail" models had no dorsal turret, and it seems likely that when this was added the array of three fins was found seriously to interfere with the rearwards field of fire; in the event of the tail turret being put out of action, this would be a particularly unfortunate handicap.

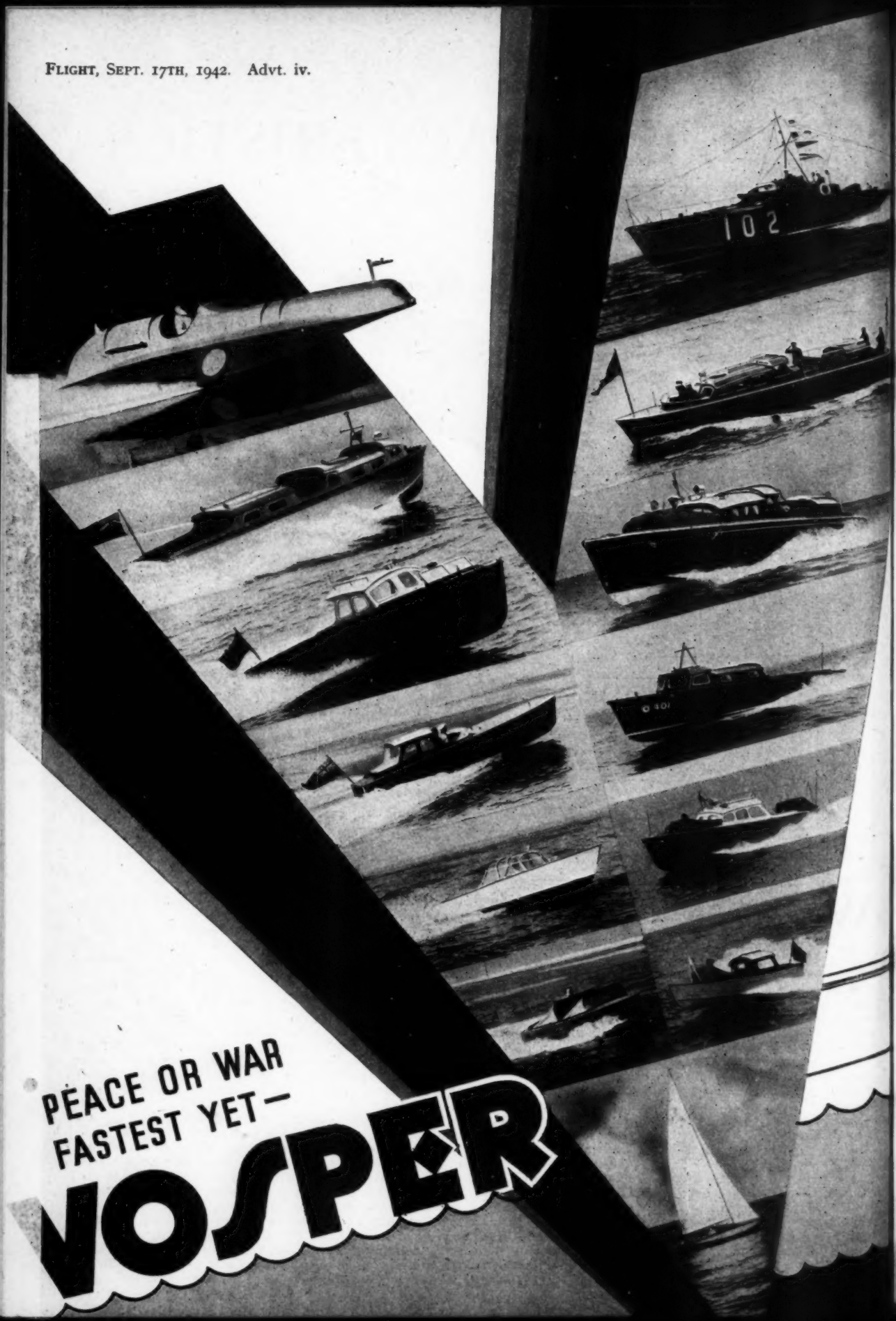
It is natural that the Manchester should be regarded as a two-engined version of the Lancaster (and vice versa) because, though there are important differences in its constructional details, the general outlines of fuselage, wing-plan and tail unit are very similar. In fact the fuselage of the Manchester is only six inches shorter than that of its four-engined successor, although the span is some 12ft. less.

Designed in a number of sections to facilitate production, transport, maintenance and repair, the Manchester is of all-metal construction and, except for fabric-covered control surfaces, is skinned throughout with flush-riveted aluminium alloy sheets. The fuselage is built up of transverse formers with continuous longitudinal stringers and the wings have a centre-section of constant chord and thickness to which are attached at a moderate dihedral angle, symmetrically tapered outer panels with rounded tips. Flaps of the split trailing-edge type are fitted.

The only one of our recently designed heavy bombers to be powered by two engines, the Manchester has a pair of Rolls-Royce Vulture engines, each with a maximum power rating of 1,845 h.p. at 3,000 r.p.m. at 5,000ft. This engine has four banks of six cylinders in the form of an "X" and set at 90 degrees to each other. Constructional details in such matters as valve arrangement and valve-gear operation follow well-established Merlin practice, and boost is provided by a centrifugal, two-speed supercharger which delivers the mixture through two main trunk pipes each feeding two banks of cylinders. The swept volume of the Vulture is 2,592 cu. in., and electric starting is employed.

The spotter will be chiefly interested, however, in the fact that the engines are carried in underslung nacelles beneath each of which bulge two radiators. Four flame-damping exhaust outlets protrude, two on each side of the nacelle which also has a wide air-intake on top. Altogether, therefore, these nacelles have a somewhat lumpy appearance and are a characteristic of the Manchester.

Its armament comprises eight 0.303in. Brownings in its three gun turrets, and its 33ft. bomb bay accommodates more than five tons of bombs. Weighing some 25 tons all up, the top speed is approximately 300 m.p.h. and the maximum range about 2,000 miles.


102
PEACE OR WAR
FASTEST YET—
VOSPER

Topics of the Day

NO MORE BALLYHOO

How the "Expert" is Ceasing to Exist in the Minds of the Common Man : The Necessity for Independent Criticism : Bridging the Gap Between the Pilot and the Non-pilot

GIVEN sufficient confidence in himself, the average person can be interesting and bright about almost any subject in the world, and I have always been convinced that it would be a good thing for every "expert" on any subject to be bombarded once a week with questions by a lot of outsiders who know practically nothing about the expert's subject.

One can, for instance, have an enormous amount of fun with an economist of the sterner and literal-minded school. He will talk knowingly about trade balances and international exchanges and of the importance of gold as a basic medium of exchange. And you can talk carelessly about the obvious fact that debts are, in the end, always paid in goods; about the absurdity of shipping (or flying) great masses of gold from place to place; and even (if the conversation turns to the business of debts of the astronomical kind incurred in wartime) about the impossibility of borrowing a loaf of bread, a locomotive or a tank "from to-morrow." The loaf, the locomotive and the tank must be made to-day, from materials obtainable to-day, and with labour which is paid for in loaves and fishes and clothes produced to-day.

Self-advertisement

However fallacious the outsider's arguments may turn out to be, the "expert" must inevitably learn quite a lot, and if, before you've finished the discussion, he turns on you with the suggestion that "it is impossible to discuss such things with a person who is basically ignorant of the subject," you know either that you're right or that he's lost track of things and is neither intelligent nor knowledgeable enough to cope with your parries.

This is a curious world in which the "experts" so often wrap themselves up in long and meaningless words, or surround themselves with a bevy of yes-men so that no ordinary person can come along with a pin to burst the bubble of their self-esteem. From art and music to advertising and production, the world is full of phoney expertness and what the Americans so long ago and so aptly called ballyhoo. No one is so disappointing in immediate contact as the large noise, whether he is political, industrial or even apocryphal. He is usually a smashing salesman of himself—and that's about all. There are quite a few exceptions, but with no capacity or liking for self-advertisement, the exceptions rarely reach the top or have any very large part in public affairs.

Wrong Standards

Nice as it may be for the general public to carry a mass of do-no-wrong heroes and heroines, one of the best and most encouraging features of the modern world is that the average person is at last learning to distinguish ballyhoo from real worth. At least one important reason why we have not so far really done so very well in this war is that it has taken us quite a long time to discover that the wrong standards have been applied by nearly everyone in the choice of "experts." In a General the ability to say and do the right things, or even to inspire affection and loyalty, is now less important than a practical knowledge of tanks, or (so very rare) an understanding of the value and uses of air power; in a politician the command of mere words, with nothing much to back them, has almost ceased to have any real significance; and in an industrialist the flair for underselling everyone else at the right moment is less important than a good common-sense capacity for organising rapid production.

Nobody really minds if mistakes are made or battles are lost, so long as something is really learnt, and so long as the real causes of an industrial or military disaster are not kept dark in a wild and useless endeavour to save the good names of those responsible. Nobody is going to have anything but kind words for the industrialist or a General who fails and openly admits that he has failed and gives a good reason for it; but heaven help the small-minded little man who covers the thing up with feeble excuses and refuses to give everyone else the benefit of the experience he has gained at such a high price in man or production power.

If anything has been on the top line during this war it has been the production of aircraft. The Powers that Be knew, rightly or wrongly, what they wanted, and the things were produced with astoundingly few hitches. But let no one imagine that mistakes have not been made. Hundreds of quite useless aircraft have been made because orders had been placed and because no one had the guts or the good sense to countermand them before too much good material and skilled labour had been wasted. The failure was not criminal—merely the result of inertia, laziness and good fellowship. There have been the inevitable cases where works have been reorganised for the immediate production of new types which, for one reason or another, have not been ready for production. It has always seemed to me to be more economical, and even quicker in the long run, to build new factories every time, rather than to reduce production on an obsolescent but worthy type while one of the factories is re-jigged for the new order. And there have even been whispered cases of sheer failure to admit errors in design, either to save a few unimportant faces or because the word "production" had become important out of all proportion to the context; faulty aircraft were, in the eyes of the Powers, more useful than no aircraft at all.

Prompt Dispersal

In the earlier days, that was where the good and sometimes maligned Maintenance Units came into the picture. So that masses of almost-completed aircraft should not be left littering a factory to the delight of the daylight raiders, aircraft were flown away and dispersed as soon as they could safely be flown, and the various outstanding bits and pieces were installed later. That was one of the Air Ministry's brighter schemes, and it worked well. Whenever shortages of odd equipment appeared, the most extraordinary movements were made—even to the extent of flying aircraft away to M.U.s and motoring quite essential parts back so that they could be fitted to the next aircraft, and so on. A lot of that sort of thing will make an interesting story after this war is over, and some of the overworked ferry pilots will understand why so many of their flights appeared to be superfluous. I once made three journeys with the same aircraft in a week. I was fairly cross about it at the time, but I discovered why in due course.

Nevertheless there have been, and will be, times when this word "production" is taken out of its context and given too important a place. For this reason I think that every factory should have a greater proportion of Service or Air Ministry personnel knocking around; not deadbeats, but real live people from squadrons and technical departments. I know that the average production manager pulls faces whenever such people are mentioned, but there is no obvious reason why they should not be as go-ahead and as interested in getting on with the war as any of the other people who are, in effect, being paid on a

NO MORE BALLYHOO

piece-work basis, and are interested only in getting aircraft out.

The business of "getting aircraft out" can be carried too far, and hundreds of man-hours can be wasted in tearing aircraft apart again before they are fit for service. Since the test pilot is the final arbiter in all things—the test pilot and his flight engineers where applicable—I am not at all sure that these worthies, like the A.I.D., should not be employed and paid, either as serving officers in the Air Force or otherwise, by the Air Ministry. The best judgment in the world can be warped by the harryings of one's employers and even by the thought of the monthly pay cheque. Not, of course, to the point of passing bad material—that would be to the detriment of all—but to the extent of hurrying and taking things rather for granted.

The Final Arbiter

Fortunately, the average test pilot is allowed to live in a world of his own and is listened to by directors and managers rather as if he is by way of being a superman; his prestige is such that if his job doesn't become too routine he can get away with anything. And that is what is wanted—the capacity and the power and the freedom to speak his mind without fear. The test pilot may sometimes be considered to be the spoilt darling of the factory, but he *is* the final arbiter in all things, and he, above all, must be free. With the sort of job he has got he won't often be either slack or bored.

Let us be quite sure that the pilots, the inspectors, and the design staff retain their absolute independence; the rest of the outfit probably works best on a piece-work basis. And that independence includes, in the case of the test pilot, a sort of moral independence as well. He must not be chivvied into the air on bad flying days by people who know no better. It may seem clever and even be encouraging to the workers to see their aircraft being flown around in heavy rain or a fog, but it is quite impossible to do the job properly in such conditions. Nobody doubts that the beastly thing will *fly*—nobody has doubted that since 1909, or thereabouts.

The test pilot's job is to see that it flies properly and that all the instruments and incidentals work. If his "test" consists of a series of steep turns at a hundred feet around the inside of the airfield, then he knows as much about the aircraft as the works and bricks chap who is digging a hole and watching his evolutions with a jaundiced eye. Maybe, to save face, to show willing, and to encourage everybody, one such circuit may be made, but it should be firmly said that the aircraft must be flown again, and no other attempts made until the weather clears up—whatever the non-flying general manager may tactlessly say at the luncheon table. He will probably make some remark about installing a blind-approach transmitter at his airfield, or about the weather being perfect for a test of the instruments; well, the test pilot, with years of practice in the business of dealing with the "what-have - we - fixed - all - the - blind - flying - instruments - in - the - thing - for - if - you - can't - fly - blind?" kind of person, will know what to say and will pour himself out another sherry. There was once a Big Chief who nearly had apoplexy because his test pilots refused to fly a prototype four-engined bomber out of the *very* emergency peacetime field next door to the works and thus save him the expense and bother of shipping the thing piecemeal to a real airfield.

The gap between the flying and non-flying person grows. The cleverest engineer is still unable to follow the simplest practical explanations unless he has flown himself; even a few hours solo in a Tiger would make all the difference. There's nothing difficult or extraordinary or supernatural about the flying business; anybody can learn. But the non-flying person is just cut off, that's all, and is liable to say the most stupid things. And *are* they obstinate and cross about it!

INDICATOR.

CANADIAN AVIATION NEWS

Glider Test Flight : New Catalina Plant : Dive-bomber Contract : First Cornell Trainer

THE first Canadian-made glider has come through its flight tests successfully, officials of the de Havilland Aircraft Co. recently announced at Toronto. The glider reached an altitude of 5,800ft. in the course of a two-hour flight which included a forced spin, from which it recovered with ease, and various types of dives. It was towed into the air by a Tiger Moth and released at 1,380 feet.

This glider, designed by Mr. Czerwinski, a Polish member of the de Havilland engineering staff, was described and illustrated in *Flight* on June 25th last.

* * *

THE first Canadian-built Catalina PBY5 amphibian aircraft was launched on July 28 at Vancouver. The Catalinas are being built in a huge new plant in the construction of which only timber was used for the trusses, columns and exterior finish, thus effecting a saving of steel needed for other wartime purposes. The plant employs 2,500 men and women on PBY construction.

At the launching, Ralph P. Bell, director-general of aircraft production for Canada, told workers at the Boeing Co., of Canada, plant to "build planes fast or pull rickshaws for the Japs." He referred to another Canadian company in eastern Canada which is also making the Catalinas.

He said it was a new organisation starting from scratch long after the inauguration of the West Coast organisation, but the eastern employees had promised him they would overtake and beat their West Coast friends. Mr. Bell predicted maximum production would be reached by 1944.

* * *

TO enable the new Curtiss dive bombers being built for the United States Navy to be test flown at Fort William, Ont., the runways of the airport there are to be lengthened by some 4,000 feet in each of two directions, according to an announcement of the Canadian Department of Munitions and Supply. The Canadian Car and Foundry Co. has a $60,000,000 contract for 1,000 of these dive bombers.

The plant will be busy at full production on this order until late in 1944. The first plane is to be produced early in 1943. Construction for the runways will cost some $895,000, and the airport has been taken over by the Canadian government for the duration.

The dive bomber is also to be built for America at the Fairchild Aircraft, Ltd., plant at Longueuil, Que., near Montreal, it was announced in the United States recently. A new plant is being built for the mass production of the dive bombers.

* * *

TORONTO'S two big aircraft plants, National Steel Car Co., Ltd., and De Havilland of Canada, Ltd., have set up a joint aircraft employment bureau where applicants for either plant are interviewed by experts. The two companies share the cost of operations.

Noorduyn Aviation, Ltd., Montreal, has set up new production records. Figures released show that in June, 1942, the company's plant produced in excess of total production for the first six months of 1941. Production for the first half of 1942 exceeded that for the same period in 1941 by 275 per cent. The company makes North American Harvard advanced trainers and the Noorduyn Norseman transport plane used for training Canadian and American air force radio operators.

* * *

THE first Cornell type primary intermediate trainer ever to be assembled in Canada was tested recently at Fort Erie, Ont., at the field of the Fleet Aircraft Co. It is a converted Fairchild-Fleet trainer in which 400 changes have been made in the original type PT-19, as originally built for the United States Army by Fairchild.

The machine was finished a month ahead of schedule and is the first of several hundred to be delivered to the R.A.F. and R.C.A.F. training camps in Canada.

The Canadian company beat three American plants engaged in production of the same model.

THE TORPEDO BOMBER

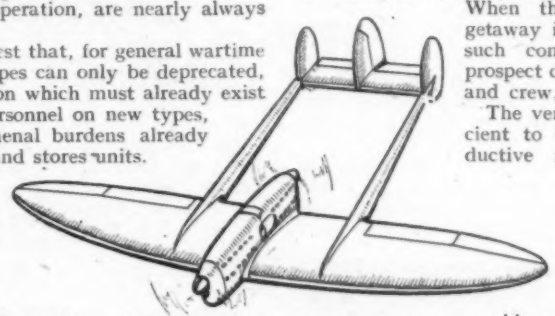
An Indictment of Obsolescent Naval Aircraft

By G. A. CHAMBERLAIN

FROM time to time *Flight* has devoted space to a survey of various original and hypothetical designs submitted by its correspondents. Invariably, this has led to a spate of controversy from the journal's readers, in the course of which debate many interesting data and experiences have been disclosed. The results are usually the same, whether the subject concerns merely a modification to an existing aircraft or even a radical change from orthodox practice. As such, the technical value of these discussions is not to be questioned, but, as is only natural, the practical issues which would be incurred in putting these machines into quantity production in wartime, and introducing them to service operation, are nearly always conveniently omitted.

In actual fact, I would suggest that, for general wartime efficiency, a multiplicity of types can only be deprecated, as contributing to the confusion which must already exist in the provision of trained personnel on new types, and in adding to the phenomenal burdens already imposed on the maintenance and stores units.

I stress these points, for it is obvious that they are insufficiently appreciated by the average reader, to whom it would appear that only the aerodynamics of the machine are worthy of serious attention, whereas any craft which does not readily lend itself to straightforward and established constructional and maintenance principles will prove a liability. In practice, it may be found that the alleged advantages of a freak design are too often merely of a temporary nature—to be superseded by something else and in any case entirely nullified by the snags I have already indicated.



The author's suggested layout is in strong contrast to the T.S.R. types of the Royal Navy.

Thus it will be recognised that the above preamble is a very essential preliminary to any consideration of playing around with existing specifications, and that if such a course *is* adopted, then a convincing proof of its need must be produced to put into operation the requisite organisation to design and produce the new aircraft. By present standards, a considerable period of time will usually elapse before a service pilot is at the controls.

The Case Against T.S.R.

Bearing all this in mind, I remain convinced that the T.S.R. specification for carrier-borne aircraft has proved rather optimistic in the light of modern naval warfare. Where the torpedo bomber aircraft (as they are frequently known) are sent against capital ships they are terribly handicapped in that they are constructed on the lines of universal adaptability.

This implies that they must be able to carry out any one of a dozen or so different duties tolerably well, but as in every compromise, something has to be sacrificed. In this case it will be found that we are compelled to send in slow, poorly armed and armoured aircraft, each with a single torpedo of reputed ineffectiveness, against the most formidable concentration of anti-aircraft defences known.

Those who are familiar with F.A.A. aircraft will agree on the amazing complexity of their equipment, and will continue to regard with wonder the performance that they do achieve in spite of this. Even so, it is quite inadequate, and tragic failures we have experienced can only be attributed to the primitive equipment at present in use.

Hence, the prime contention of this article lies in its plea for a highly specialised form of aircraft typified by the term "Torpedo Attack."

As the name implies, the outstanding feature required is the ability to get to close quarters with the enemy and to deliver the maximum possible weight of explosive with an accuracy consistent with the confidence enjoyed by an attacker adequately protected from all but a direct hit by a large-calibre shell.

The attacking force *must* be fast and well protected in order rapidly to close with the enemy and to evade any protective fighter screen. Having gained access to a range suited to good markmanship, the machine should be able to reduce speed suddenly without loss of height or stability, to the optimum speed required for discharging its load. When this has been done, a rapid getaway is essential, and there is under such conditions, therefore, a greater prospect of survival both for the machine and crew.

The very nature of the target is sufficient to warrant the diversion of productive facilities for this specialised weapon. It is only on rare occasions that a capital ship allows itself to come within range of attacking aircraft, and the first combatant who can produce the weapon which will give some reasonable guarantee of success will go a long way to crippling his opponents' transport system and winning the war.

It must be clearly understood that the T.S.R. specification was issued many years ago in the illusory days of a so-called "peace-time," and therefore was based on theories which, in the light of modern air-naval warfare, have been proved to be too flattering to the air arm. Aeronautical research and practice have not been allowed to keep pace with the ordnance developments of naval construction.

That such improvements as outlined above must appear eventually is the belief of the writer, and whilst admitting the critical comment that to produce the required aircraft type would entail a considerable period of time, it can be stated that the date has not yet been fixed for Armistice Day, and that every delay in producing this weapon is increasing the handicap under which naval aviation is working.

However, I have attempted so far merely to lay down a general principle, and criticism without justification and amendment is only destructive, so I propose to describe the type of machine which I myself consider would meet the situation. If this action alone were to provoke designers and others into an appreciation of the urgency of the demand, it will have served its purpose.

Requirements of "Torpedo Attack"

Briefly then, I would specify that this aircraft should possess no armament whatever (apart from its two 21in. torpedoes), but would be heavily armour plated in its most vital areas. Its performance would of necessity approximate to that of fighter aircraft, with the additional feature of rapid deceleration and acceleration (probably obtained from flaps, airbrakes and reversible-pitch airscrews). It would have two engines (of an approximate total 4,000 h.p.) to provide the high performance and acceleration, and the ability to continue to the target area if one were disabled.

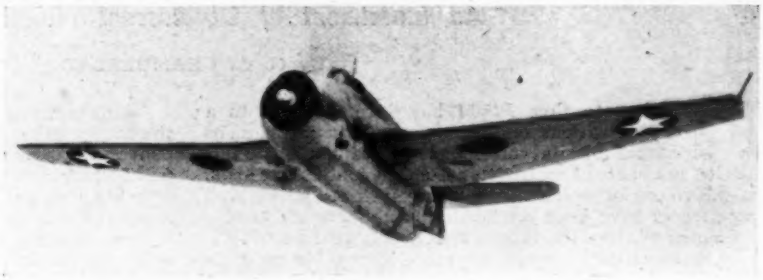
The engines will be mounted in tandem for these reasons:—

1. Reduction of overall width for use on lifts of carriers.

THE TORPEDO BOMBER

2. No great directional deviation if one engine defaults.
3. Additional protection for pilot.
4. Shorter fuel leads and controls, with consequent diminution of vulnerability.
5. Smaller frontal target area offered to ships' gunners.

The pilot would be placed in an armour plate enclosure between the engines. This enclosure would be stressed as part of the airframe and would encompass the fuel tanks, main controls, and the pilot's accommodation as one unit. It is, in fact, virtually a tank turret in miniature, and it should be well within the limits of designers to cope with this.



Probably the most advanced torpedoplane in use in any navy is this Grumman Avenger (U.S. Navy), which carries its 21in. torpedo internally, so that drag is reduced and heating facilitated.

I believe I am right in saying that Lindbergh largely relied on a periscope for forward view when carrying out his famous transatlantic flight, and thus it may be possible that this feature also could be incorporated with a view to providing as much bullet-proof protection to the cockpit as vision would permit.

I have no data available on the behaviour of the tricycle undercarriage on a landing deck, but at first sight it would appear to have several desirable features for this duty, and in this case would enable the rear airscrew to have a good ground clearance.

The low-wing monoplane arrangement would of course give housing to the retractable undercarriage, and would develop into a bulbous centre section containing the two 21in. torpedoes which I consider essential for packing the required punch. The nose wheel would retract within the narrow space between the torpedoes, or vertically into the front engine bay.

For operational purposes I would suggest that the wings fold upwards from the centre section, and presumably these could function by the hydraulic system whilst the pilot is still at the controls.

The radiator scuttles are one on each side of the *nacelle*, and in passing it should be pointed out that the liquid cooling system is probably the weakest link in the whole structure where vulnerability is concerned, and that special measures would need to be adopted for its protection. If it were possible to provide *air*-cooled motors of adequate power and still retain efficient cooling on the rear one, it would be preferable to employ this arrangement.

A short-range two-way R/T system would probably be quite sufficient, as it is proposed that these aircraft should operate under fighter escort the whole time.

Summary

Hence it will be observed that the bulk of normal aircraft equipment is superfluous, and should in this case be treated as such. Many of the usual manufacturing difficulties and expenses will then disappear, and the design will not be quite so difficult or take quite so long as at first imagined.

As regards the operational strategy employed, obviously a mere flight of half a dozen "Torpedo Attack" machines on every carrier is sufficient. Add to this the systematic location of shore-based aircraft of this pattern along our coasts and on the Empire routes, and an effective network would then establish a deadly threat to all our enemies afloat.

Boulton Paul Changes

CAPT. W. H. SAYERS and Dr. A. G. Odgers have severed their connection with Boulton Paul Aircraft, Ltd. Their future plans have not been made known to us, but long connection with aircraft design and manufacture would appear to be an indication that they are not likely to stray very far from the aeronautical fold.

Top-scoring Hurricane Squadron

AN R.A.F. Hurricane squadron which has carried out many successful intruder patrols over enemy territory is Fighter Command's top-scoring unit for this war with more than 230 enemy aircraft destroyed.

The records of this squadron—one of Britain's oldest—proves the versatility of the Hurricane as well as the skill of its pilots. When war broke out the squadron was ordered to France and, with other Hurricane units, fought against the vastly superior numbers of aircraft thrown against them when the Germans broke through in May, 1940. By the time they withdrew they had destroyed more than 150 enemy aircraft.

Back in England, they helped to smash the *Luftwaffe's* attempted air invasion of this country, and when, in 1941, Fighter Command began its own offensive the squadron was again in the front line. By this time their Hurricanes were more deadly machines, with a much greater fire-power than those with which they had fought in France. In between their daylight sorties over the Channel they carried out night patrols, and on May 10th-11th, when our defences had their most successful night against the German raiders, they destroyed seven out of the 33 enemy aircraft brought down.

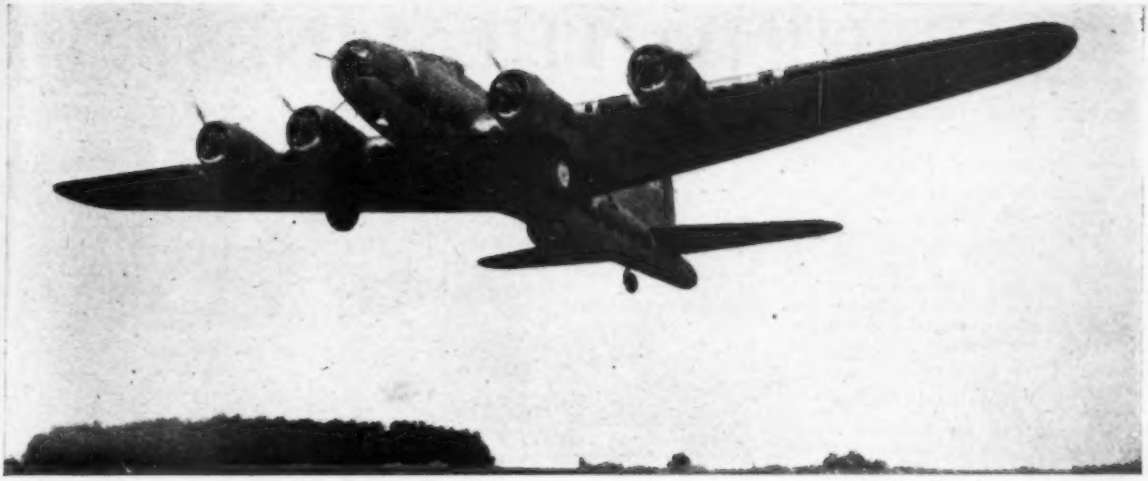
It was about this time that a Czech sergeant, named Kuttelwascher, began to shoot down German aircraft at regular intervals. To-day he is a flight lieutenant and Fighter Command's top-scoring intruder pilot—three in one night is his best "bag" to date.

The squadron began its intruder work with four-cannon Hurricanes early this year, and so far has destroyed 23 enemy aircraft at night over or near their own bases. Its repeated attacks on railway engines have also helped to disorganise communications and transport in Northern France.

Aircraft Gunner's Seat Turns with Gun

A COMBINATION swivelling machine-gun mount and seat that preserves the same relative positions of gunner and gun so that no time is lost in taking a new sight when the gun is swung from one target to another has been patented in the United States by Major Alexander P. Seversky and assigned to the Republic Aviation Corp., of Farmingdale, New York.

The invention comprises a circular track to be mounted in the upper part of the rear cockpit of a dual-control fighter 'plane, carriages that ride on the track, and arms on the carriages to which is fixed a truss for the gun and the gunner's seat. A hand lever enables the unit to be turned and locked in any desired position. Without leaving his seat the gunner can swivel around, facing forward and take operating control of the 'plane in case the pilot is disabled.



FORTRESSES CAN FIGHT

Success of the 0.5in. Machine Guns in Latest Models : Twelve Enemy Fighters Shot Down

ON Monday, September 7th, Flying Fortresses of the Eighth Air Force of the United States Army in Europe made their fourteenth raid on enemy targets. Rotterdam was the main objective, though the shipyard at Schiedam and the railway yards at Utrect were also visited. The Fortresses were escorted to Rotterdam by Spitfires from Fighter Command, consisting of R.A.F. and R.C.A.F. squadrons, while diversionary sweeps were made by squadrons of R.A.F., Dominion and Allied fighters. The Fortresses were of the latest model (which embody the results of R.A.F. experience with the earlier type) and each was armed with twelve half-inch and one 0.303 machine guns.

While returning from Rotterdam enemy fighters attacked one formation of the American bombers, and an engine of one was damaged. The machine fell behind and enemy fighters, all or most of them of the type Fw.190, attacked it. The fire from this machine sent several of the fighters down in flames, and more were damaged and probably destroyed. Altogether the bombers shot down twelve enemy fighters for certain, and all the Fortresses returned to their bases.

In the damaged bomber one gunner was killed and three other members of the crew were wounded. One of the escorting fighters was lost, but details have not been published of the part played by the Spitfires in protecting the bombers.

The Eighth Army Air Force of the United States has made a very fine start in its bombing work. The quality of the crews is very good, and they fight, as we all felt sure they would, with great determination and skill. The shooting by the crews and the tactics employed are good. The Americans listened in a most friendly way to all the R.A.F. could tell them.

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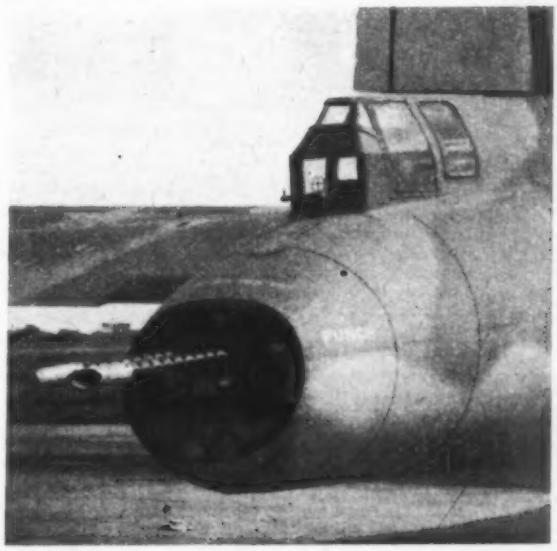
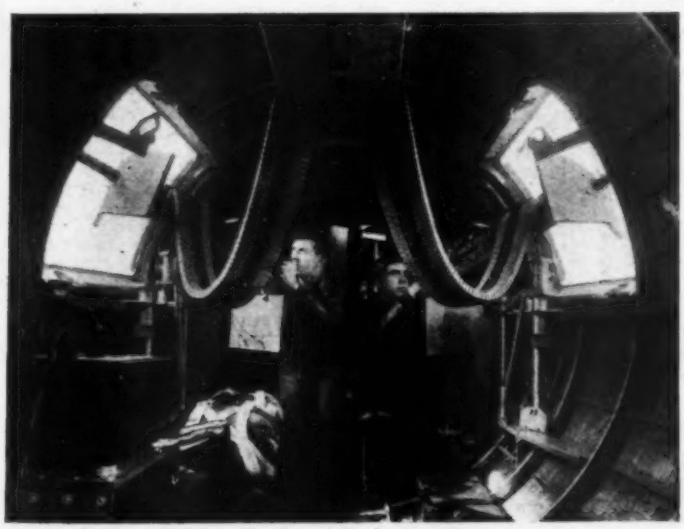


The sting in the Fortress tail. The gun sight can be seen just aft of the gunner's post under the rudder.



How the Fortress repels attack by fighters. Note the armour plates which protect the gunners.

BEHIND THE LINES

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Marseilles' Future

IT is reported from Vichy France that the Marseilles-Marignane airport is to be shortly closed to civil traffic. The airport has facilities for land and sea aircraft and is to be used in future for military purposes. Marignane was the starting point of French African Services, and one wonders whether the switch-over to military employment has not other implications.

The Pendulum Doctor

THE effect on the Germans of the R.A.F. visits is illustrated by an amusing item which appeared a short while ago in the German daily Press. Despite Dr. Goebbels' speeches, the people of the Rhineland seem to be very anxious to know where the R.A.F. will strike next. According to the German Press a shrewd man in Mannheim has found this anxiety a wonderful source of income.

He established a regular "practice" by placing his patients over a map and putting a swinging pendulum on their temples. From this, and for a good fee, he could advise the warring Germans of the location of future R.A.F. raids. It is significant that the "pendulum doctor" was practising for a very long time until he was recently sentenced to two years' imprisonment.

Decorations and Losses

GENERAL FRIEDRICH VON BOETTICHER, formerly Military Attaché at the German Embassy in Washington, and a well-known German military expert, has been awarded the Knights Insignia with Sabres to the Nazi Military Order of Merit. Four more Lieutenant Generals have been promoted to the rank of "General der Flieger" and a continuous exchange of decorations between the *Luftwaffe* and the Italian Air Force is still in progress. Recently a number of Italian Air Officers have been decorated with the Order of the German Eagle, and Field Marshal Kesselring, C.-in-C. of German *Luftwaffe* in the Mediterranean area, has presented the Iron Cross to Divisional General G. Maceratimi and Brigadier General M. Ceretti in recognition of their services in the supply and ground organisation of *Luftwaffe* air bases in North Africa.

First Lieutenant Hans-Joachim Marseille, Squadron Leader in a fighter group, was awarded the Oak Leaves with Sabres to the Knights Insignia of the Iron Cross, in recognition of his "101st victory." Lieutenant Clausen, of a fighter squadron, who has been with the *Luftwaffe* since 1935, has been awarded the same decoration for action on the Russian front. Lieutenant-Colonel J. Hahn, holder of the Knights Insignia, Commodore of a bomber squadron, and one of the crack men of the *Luftwaffe*, was killed in action on the Western front against the R.A.F.

Also in the East the *Luftwaffe* is losing the flower of their personnel: among such losses the names of Major-General Julius von Bernuth, Lieutenant A. Schmaltz, a Commandant of a Stuka Unit, and Colonel Fritz Doesch, of the German Air Ministry, are given special prominence in the Nazi Press.

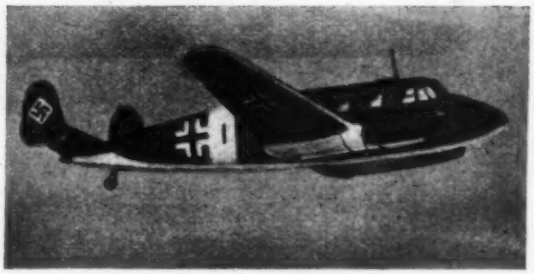
New Aircraft Plant

THE trend of the German aircraft industry to expand into areas less vulnerable to air attacks is demonstrated by the formation of a new company in the Riesengebirge. This is the "Bartaune A.G.," a company hitherto hardly heard of outside Germany, which is engaged in the manufacture of aircraft and components. It is reported that foreign skilled labour is employed by this company in their works at Hirschberg.

Synthetic Fuel

THE rich deposits of brown coal situated in the district of Aix-en-Provence are to form the basis for the production of synthetic fuel. With the co-operation of the Vichy Government a company named the "Compagnie Centrale d'Hidrogénation et de Synthèse," has been formed and the first plant is to be shortly erected.

It can be assumed that Laval's Government is co-operating in this venture with the Nazis, since the German Fischer-Tropsch process will be applied to the manufacture of the synthetic petrol, and, significantly enough, the headquarters of the company are in Paris. The construction of further plants is planned.



A GERMAN COMMUNICATIONS TYPE: The Siebel Si.204 is powered by two Argus As.410 engines of 450 h.p. each.

Siebel Si.204

A NEW twin-engine aircraft came recently into service with the *Luftwaffe*. This is the Siebel Si.204, hitherto not known to have been in quantity production, which is to be employed for communication duties. The Siebel Si.204 has a twin rudder and accommodates eight passengers, with a crew of two. The aircraft is powered by two Argus As.410 eight-cylinder inline engines of 450 h.p. It is manufactured by Siebel Flugzeuwerke, of Halle.

Luftwaffe's Mentor

THE *Luftwaffe* has a special institute for the training of staff officers. This Air Academy, which is situated at Gatow, near Berlin, is commanded by Maj. Gen. Dr. Knauss, an "old-timer" of the German Air Force who served during the last war. Dr. Knauss later became a director of the *Lufthausa* and accomplished the first flight from Germany to Clisna. In 1935 he again joined the *Luftwaffe's* staff and was entrusted with the training of staff officers.

THE BACK DOOR AT THE FRONT: This photograph shows the entrance to the lower gun turret of the Junkers Ju.88.

FORTRESSES CAN FIGHT

(*Continued from previous page.*)

and then made up their own minds on how to conduct their operations. The B-17 has proved itself a sturdy machine, able to stand up to damage. Its armament is heavy, and the half-inch machine gun introduces a new feature into air combat. It is a hard-hitting weapon, and with good gunners to fire it, its long range keeps many enemy fighters from closing in on the bombers.

So far, the American squadrons have attacked places on the coast of enemy-occupied territory, and have had Spitfire escorts by day. It may soon be found that the Fortresses are able to look after themselves and dispense with escorts. Then, no doubt, they will penetrate further inland. They may initiate a campaign of daylight bombing, which is certainly more accurate than night bombing.

It is notable that the Germans have not yet mentioned that the U.S. Army Air Force is at work, obviously they do not want to depress their own people.

PLASTICS and AIRCRAFT

An Introduction to Their Composition, Mechanical Properties and Adaptability

By W. NICHOLS, A.R.Ae.S.

THERE are many who feel that insufficient use is being made of plastic materials in aircraft construction, and that the Americans have shown a greater appreciation of the possibilities of saving metallic materials which are in short supply.

In last week's issue we published a description of the so-called Vidal process of bonding plywood structural members with plastics. In this, and subsequent issues, the whole position of plastic materials and their application to aircraft will be reviewed.

SINCE the outbreak of war little has been published in this country concerning the development of plastics as applied to the aircraft industry. There is a small "Plastics Dept." within the Ministry of Aircraft Production, and it is known that a few people are engaged within the aircraft industry in developing this newest method of aircraft construction, but in keeping with the popular fallacy that this is a "private war," the result of their efforts are confined to themselves.

In America, however, a rather more enterprising policy exists, and quite a lot of information has been published from time to time which shows that progress is being made on the right lines and that nowadays, when priority materials need to be conserved for the "right job" only, they are given every encouragement by their Government to "get cracking." It is to be regretted that such a sound policy does not exist over here, for it is certain that by the development of plastics for use in connection with the manufacture of aircraft and aircraft components a great saving of priority materials could result.

Materials and Processes

This article sets out to describe the plastics materials and various processes involved which could be used to advantage in the production of aircraft and aircraft components. Most people who have written upon plastics as applied to aircraft usually begin by saying that the plastic aircraft as such is still a misnomer, and that it is not possible so far to produce the ideal moulded machine. This is, of course, quite correct, but although the "plastic" aircraft may still be far distant, the time is already here when plastic materials can be largely used to great advantage in the aircraft industry, and from the war effort point of view alone, therefore, "plastics" are of real importance now to aircraft production.

The term "plastic" is applied within the plastics industry in a comprehensive sense, and it would probably be more correct to say that the substances are moulded while in a plastic state.

In some branches of the plastics industry there is a distinct resemblance to sheet-metal work practice, inasmuch as the materials are worked up and produced from sheet, rod and tube, while in addition "dies" are also sometimes used to give form and shape. Generally speaking, however, it can be said that the great bulk of plastic products are produced via the mould.

Plastic materials are both organic and inorganic, and synthetic resins are usually employed. It is convenient to classify these under two main headings, viz., (a) Thermo-setting, and (b) thermo-plastic. The former are defined as resins which flow at a certain temperature and, once allowed to cool down, will not flow upon further or re-application of heat. These compositions include chiefly the phenol-formaldehyde resins and also the cresot-formaldehyde and urea-formaldehyde resins.

The thermo-plastic variety is, of course, the reverse of the thermo-setting. These resins "flow" when sufficient heat has been applied, and "set" when the heat is removed, but they can be made to "flow" again upon reapplication of heat. These resins usually flow at about 200 deg. F. The compositions are bitumen, pitch, shellac, cellulose-nitrate, cellulose-acetate, benzyl-cellulose, etc.

It should be mentioned here that both these plastics require what is termed a "filler" before they can be moulded. The plastic itself acts more or less as a binder, the "filler" being a substance supplying the necessary strength to give shape suitable for the intended purpose.

The usual fillers in the plastics industry are powdered, flake, or in fibrous form. China clay and French chalk are examples of the first variety, whilst fibrous fillers include wood flour, cotton and silk flock; also asbestos in cases where heat resistance may be an essential requirement.

Rosinoids and Plastics

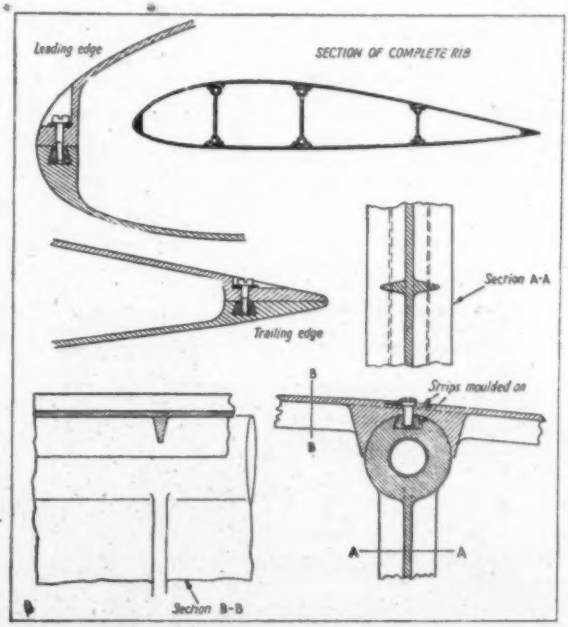
Phenolic, made from carbolic acid (phenol) or cresylic acid (cresol), together with formaldehyde; probably the most common in use in the plastics industry. Phenol and cresol are extractions from coal-tar; the former is made synthetically from coal-tar benzine. Formaldehyde is the product of wood distillation, but can also be obtained from coke-oven or producer gas.

Urea.—Urea is the result of heating carbon dioxide and ammonia while at high pressure.

Cellulose Plastics.—These comprise cellulose-acetate, cellulose-nitrate, and benzyl-cellulose. They are variously derived from cotton, paper pulp or wood pulp.

Acrylic and Vinyl.—Possess the advantage of a glass-like clearness and are derived from acetylene. It will be seen later in this article that the former especially is extensively used in the aircraft industry in connection with windscreens, transparent hoods, and covers, etc.

Casein.—Has been used extensively in the past in the aeronautical plywood industry as an adhesive. It



Suggested design for a plastic wing with spar booms reinforced by metal tubes. It was originated some years ago by the Deekay Aircraft Corporation.

PLASTICS AND AIRCRAFT

is a product of skimmed milk. The process consists of heating the skimmed milk in a stirring pan and adding "rennet" until a curd forms. It is then washed, pressed and partially dried, and the material is then formed into rods or sheets. It can be toughened and rendered proof against decomposition by soaking in a formaldehyde solution.

As an example of the properties of plastics which are common in the plastics industry, the following are quoted:

"Bakelite" (phenol-formaldehyde)

Specific gravity	1.35-2.0
Tensile strength, lb., sq. in.	4,000-8,000
Crushing stress, lb., sq. in.	25,000-35,000
Shear stress, lb., sq. in.	8,000-12,000

"Beetle" (urea type)

Specific gravity	1.49-1.63
Tensile strength, lb., sq. in.	8,000-10,500
Shear strength, lb., sq. in.	13,000-16,000

So far the subject of plastics has been considered from the point of view of the plastics industry, to give an idea of the various resins used and their origin. Now attention can be turned to how some of these plastics can be, and have been, made use of in the aircraft industry.

Properties Required

If one were asked what would be the properties of an ideal plastic material to be used for the construction of aircraft, the first qualification would be that it must be comparatively cheap to produce and be of an unvarying and reliable quality throughout; non-inflammable (an essential feature), free from shrinkage and any liability to decay. Secondly, it would need at least the equivalent strength-to-weight ratio of, say, spruce or ash timber, with the added advantage that it could be welded as easily as mild steel, and could be formed by the use of a mould or press in addition.

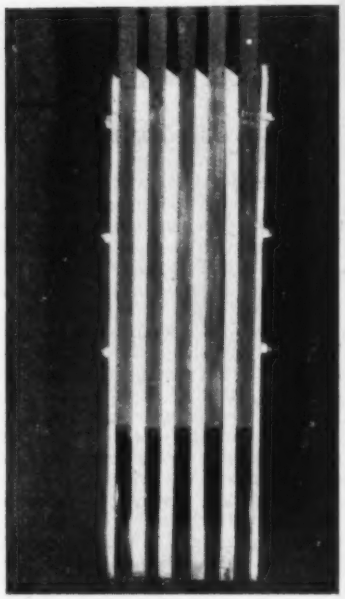
So far as is known no such material has ever yet made its appearance, but in the aircraft industry there are various materials available of a synthetic nature, consisting of artificial resins and suitable fillers, usually all termed "plastics," and familiar under their trade names to most people in the industry as Bakelite, Tufnol, Perspex, Plexiglass, Rhodoid, Micarta, etc., all of which have a very useful purpose; but they are not structural materials.

There is also an application used in the manufacture of airscrews known as the "Schwarts" method and the "Jablo" method. These have both been described in *Flight* in the past and can be dismissed lightly here by saying that they rely upon the impregnation of wood veneers by a plastic resin, and it is this process that appears to have been applied most successfully so far in aeronautical engineering not only from the point of view of airscrew production but, as will be seen later, of complete aircraft.

Another important advancement is the use of plastic resins as an adhesive in place of glue in the manufacture of aircraft plywood. This has resulted in a much improved material.

The use of plywood in the construction of aircraft in the last war, and afterwards for the light aircraft class, has been extensive in spite of its early disadvantages. Inflammability was not its major disadvantage, since with fuel present in any aircraft that is always the major fire hazard.

The chief disadvantages of plywood as an aircraft material during and just after the last war seems to have been the character of the adhesives, mainly casein and albumen glues. Such adhesives would not stand the mould and fungi tests, and both encouraged parasitic growths.



Spar root designed by Dr. N. A. de Bruyne. It consisted of a "sandwich" of duralumin plates and synthetic plastic material, bolted together.

During the past twelve years, however, in the development of the plastics industry resin adhesives have come into use such as has been already described of the phenol formaldehyde and urea formaldehyde group. As a result, the following advantages have been secured:—

(a) Complete waterproofness, the adhesive being insoluble until the wood decays.

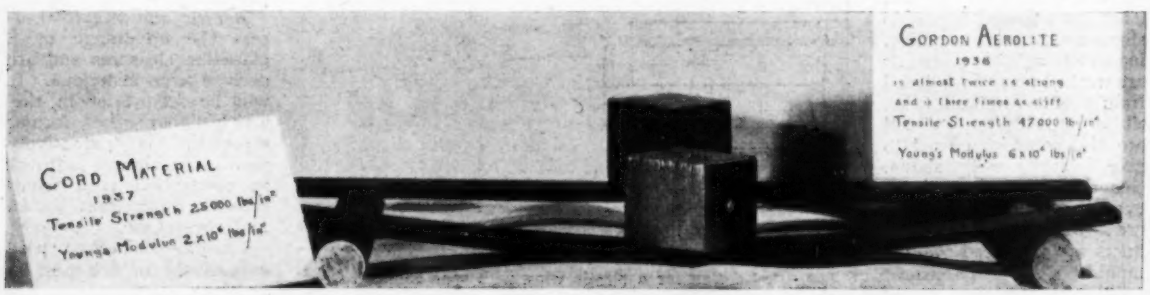
(b) High resistance to bacterial growth.

(c) Boilproofness which facilitates bending and curving after steaming.

Liquid Phenolics

The liquid phenolics are found to possess the same desirable qualities as the resin in film form, but the technique of bonding with a film is much more simple than with the liquid form. Whichever method is used, the process is similar, inasmuch as the assembled veneer sheets with the adhesive are subjected to simultaneous heat (300 deg. F.) and pressure (125 lb. to 250 lb. per square in.) during manufacture. The urea groups can be set at the much lower temperature of 170 deg. F. Thus it is possible by the aid of plastics to produce an ideal plywood for aircraft construction, having superior strength characteristics and enabling the craftsman to meet design requirements which are not even possible with normal wood or plywood.

As will be seen later in a description of some of the processes at present utilised, the so-called "plastic aircraft" so far have been made of moulded wood veneer or plywood with resin adhesives and finish; and a very good job



Cord material and "Gordon Aerolite" compared. The latter is twice as strong as the former.

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has resulted if reports from various sources are accurate. There is not the slightest doubt that modern plywood presents many new and undeveloped possibilities in the aircraft industry which will come under review later in this article.

To leave for the time being the possibilities of plywood, this article would not be complete without reference to the work of Dr. N. A. de Bruyne, M.A., Ph.D., who for some years has been engaged upon research in developing synthetic materials for aircraft construction. From results so far published, Dr. de Bruyne has confined himself mainly to perfecting a material known as "Cord" material. Unfortunately, since the outbreak of war, little has been published as to the development of this material, but early in 1939 Dr. de Bruyne gave a lecture before the Weybridge branch of the R. Ae. Soc., and some details of this reinforced type of synthetic resin material were given.*

For Built-up Structures

From this lecture it appeared that the latest developments at that time had resulted in a material known as "Gordon Aerolite" and that this material compared very well with others in use in aircraft construction. It was also learned that it was produced in plank form, normally 6in. wide and 30ft. long, and of any required thickness. In addition, by means of a "press" designed for the purpose, spars of an "I" section of unlimited length could be produced.

It is obvious that this material is not one which will lend itself to the production of moulded wings and fuselages; it is intended for use in built-up structures and spars on the girder principle. The density of the material is sufficiently low to make unnecessary the use of elaborate extruded sections so that it could be used in plank form.

The chief problem at that time appeared to be making the connections, as the shear strength was only one-eighth that of its tensile strength. As Dr. de Bruyne pointed out, the ratio for wood was worse, but wood could be glued and at that time glued joints was not a satisfactory proposition with "Gordon Aerolite." For a mechanical joint, therefore, the common hole and bolt or pin was not possible, but a very ingenious system of interlocking dowels was developed which proved under numerous tests to be efficient.

The position in 1939 at the time of this lecture was that "Gordon Aerolite" was a material of good strength-to-weight characteristics obtainable in almost unlimited lengths, which could be built up easily into structures capable of withstanding heavy loads. Obviously, further developments have taken place since then, but there seems possibilities of using this material for the production of transport aircraft without interfering with priority material supplies for aircraft for the services.

"Gordon Aerolite," then, is a special linen-reinforced plastic material (phenol-formaldehyde), probably the nearest approach to any plastic material yet made possessing comparable strength with metal. Its production in plank form can be fabricated by the manufacturer. Its properties are as follows: Tensile strength lb. per sq. in. = 45,000; compression lb. per sq. in. = 24,000; Young's Mod. = 6.0×10^6; shear lb. per sq. in. = 5,000; spec. gravity = 1.43. It is highly probable that these figures have now been considerably improved upon.

[In addition to the material described by our contributor, Dr. de Bruyne has been at work on many others, and has also achieved considerable success in the development of cements suitable for joining parts made of plastic materials. In our issue of December 28th, 1939, we published an article by him on the nature of adhesion, and on November 6th, 1941, we described a new cement for joining fully cured Bakelite materials. Since then we have been privileged to inspect samples of still another cement, which promises remarkable results.—ED.]

Other materials in common use in the aircraft industry are *Impregnated Wood*, use being made of compound wood of very thin veneers about 0.1 to 0.3 mm. thick, impregnated with an alcoholic solution of phenolic resin and pressed together under heat and heavy pressure to form a strong, rigid material. The spec. gravity is given as about 1.27 to 1.4.

Compressed Wood.—This is also produced from veneers, with interlayers of synthetic resin adhesive either in the form of liquid or solid coatings, and pressed together under the application of heat. The difference between impregnated wood and compressed wood is that the former is lighter and possesses a higher impact strength. On the other hand, impregnated wood has a higher Brinell hardness and superior tensile strength and improved electrical qualities. Both these materials are already used in aircraft construction up to a point.

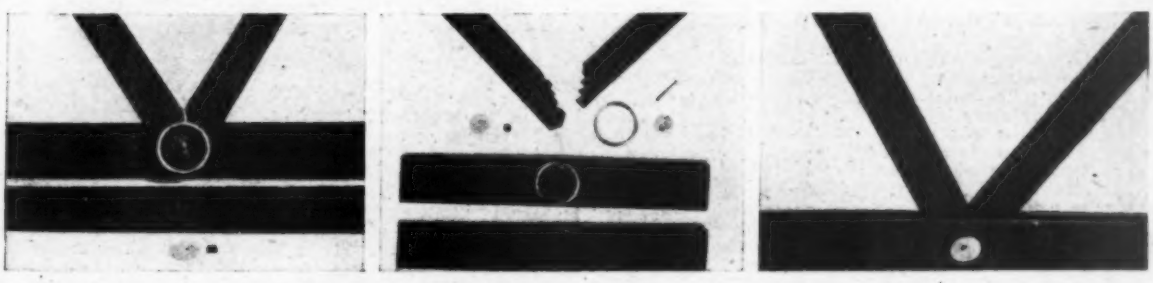
It has already been mentioned that the usual "fillers" in the plastic industry are powdered, flake, or of a fibrous form, some of which have been described. It should be stated, however, that phenol-formaldehyde moulding powders with wood flour or fabric fillers are not used to any great extent in the aircraft section of the plastics industry, except for small accessories and fittings, the more important being moulded pulleys for controls, which, incidentally, do not corrode or "bite" into the cable. Of the reinforced synthetic resins most widely used, laminated sheets of paper or fabric find applications for instrument panels, switchboards, electrical parts, gears and pulleys, etc., the much-used "Tufnol" being a material of this variety.

Synthetic Glues

These are increasingly used, both in liquid and solid form, particularly the thin sheets of tissue paper impregnated with phenolic resins and known by such names as "Tego-film" and "Plybond." Of the better-known urea glues can be mentioned "Kaurit" and "Aerolite," both of which can be used in the cold as well as the hot pressing method.

This article has briefly reviewed the plastic materials available to the aircraft industry. In the concluding section how they may be applied to advantage will be described.

* The paper was published in *Flight* of January 12th, 1939.—ED.



Dr. de Bruyne's method of making joints in a girder spar by a system of interlocking dowels. The circular grooves were cut with a trepanning tool!

WORLD PRESS SUMMARY

RÉSUMÉ OF TECHNICAL ARTICLES DEALING WITH AIRCRAFT AND ASSOCIATED SUBJECTS

For the summaries and translations from aircraft and technical journals of the world, we are indebted to the Directorate of Scientific Research and Technical Development, Ministry of Aircraft Production.

Japanese Types

ATTENTION has repeatedly been drawn to the difficulties which present themselves to the European in the distinction of Japanese aircraft types. It is known that the Japanese aircraft designations contain the two last figures of the construction year of the prototype in the Japanese reckoning of time (00 stands for the year 2600 of the Japanese or 1940 of the Christian era); later reports state that the figure represents the year in which the production model was taken into active service. Ahead of this figure, the Japanese designations contain one or two letters which represent the aircraft class and were not so far used as a general rule or replaced by the letter "T" (for Type). Fighters are designated by "S" (e.g., Kawasaki S-97), light bombers of the Army Air Force by "KB," medium bombers by "B" (e.g., Mitsubishi B-96 "Otori"), heavy bombers by "OW," torpedo bombers by "G," naval dive-bombers by "K" (for Kyukoki), reconnaissance aircraft by "T," reconnaissance floatplanes by "KT," flying-boats by "H," transport aircraft by "Y," and trainers by "K" (for Kyorenki).

Japanese Type Designations. ("*Inter Avia.*") (Japan.)

Radiolocation

Methods for Finding Targets, Especially for the Determination of Aircraft Positions.

THESE methods operate on the back-radiation principle. A transmitter scans the explored space in two dimensions, while the back-radiation from a body in that space causes in a receiver an intensity variation of a cathode-ray beam which is deflected in synchronism with the transmitter.

—D.R.P., 702,686, published February 15, 1941, A.E.G. Inventor, T. Elmquist.

Methods for the Determination of the Distance of Reflecting Objects, According to the Back-radiation Principle.

The wavelength of a radiated beam is varied between two fixed values in successive half periods of a modulation frequency M. If the time interval between the transmission and reception of the reflected wave is a whole multiple of the modulation frequency, the beat amplitude in the receiver will be a minimum.

In order to obtain an exact result for the distance d, the minimum is determined for two adjacent values M, N′ on the modulation frequency.

If the time interval is $o = 1/(N - M')$ then the required distance $d = UO/2$ where U = the velocity of propagation of the waves.

—D.R.P., 703,111, published February 28th, 1941. Compagnie de Telegraphic sans Fil, Paris. Inventor, H. Gutton.

Foreign Radiolocation Patents. ("Electronic Engineering.") (G.B.)

Carburettor Air Scoops

THE design of a carburettor airscoop involves:

1. Location of the intake opening to receive full air-speed ram and exert minimum drag (which involves knowledge and experiment as to the external air flow around the airplane; and

2. Conducting the intake air to enter the carburettor with uniform pressure across its stream with minimum turbulence, and minimum loss of impact pressure (which involves the study of internal air flow).

In general, the two main objectives, maximum ram and minimum disturbance of carburation, go hand in hand and have the same structural requirements.

An analysis is given of the principles of fuel-air metering, by measuring the air velocity differential through air orifices of fixed size, and transmitting this differential, corrected for variations of air density, to secure corresponding fuel flow differential through selected fuel orifices. A description is then given of the departures from steady full-stream air flow encountered in flight service, and the manner in which these affect air-speed metering.

Methods are given for detecting, measuring, and curing disturbances from these sources.

Recommendations also are given for improved warm and cold air control, for protection against ice formation in the intake system, by eliminating the variable ram differential between cold and warm air flow which exists with most current scoop designs.

In conclusion, the need is emphasised for freer co-operation between aircraft, engine, and carburettor engineers; and for recognition in our procurement procedure of the need for preliminary check tests in actual flight, on prototype aircraft, of the design and characteristics of not only the scoop and carburettor, but also all other engine accessories whose functioning may be affected by differences between flight and ground-test conditions

Aircraft Carburetter Air Scoops and Their Effect on Fuel/Air Metering in Flight. (F. C. Mock, *S.A.E.J.*) (U.S.A.).

The Kensei Engine

THE engine had been damaged in a crash and only certain parts were available for inspection to the author, who carried out an examination on behalf of the Wright Aeronautical Corporation. The parts examined include:

Crank case, crankshaft, piston and connecting rods, cylinder and valves, reduction gear, accessory drives and supercharger. Rear cover plate (including carburettor) and front cover plate (including propeller) are missing. The propeller was apparently of the two-position type. The author concludes:

(1) The Japanese designer combined in an ingenious manner proved features of a number of products of foreign manufacture, mainly American. The engine should be highly dependable, though not highly developed, and probably gave its rated output without requiring any subsequent modifications.

(2) The manufacturing methods and equipment utilised produced parts of a quality comparable to the originals copied.

(3) The materials utilised show that there were adequate supplies of Ni, Cd, Co, Cn, No and tungsten at the time of manufacture.

It is interesting to note that this engine is not fitted with a vibration damper.

The general data of the 14-cylinder radial engine are given below:

Bore and stroke	5.5in. × 5.92in.
Diameter	47in.
Piston area	332 sq. in.
Displacement	1,970 cu. in.
Compression ratio	6.6.
Impeller diameter	9.62in.
Supercharger gear	8.48 × crankshaft.
Performance estimate on 95-100 octane.	
Cruising	650 h.p. at 2,000 r.p.m.
Rated (8,000ft.)	850 h.p. at 2,250 r.p.m.
Military rating (5,500ft.) and take-off	1,050 h.p. at 2,500 r.p.m.

Some Notes on Design Features of a Captured Mitsubishi Kensei Engine. (W. G. Owen, S.A.E.J.) (Japan.)

Hydraulic Energy Diagrams

SPACE time recorders are essential for the calculation of energy diagrams of the hydraulic elements in landing-gear shock absorbers. Most of the instruments employed so far for this purpose depend on mechanical linkages and are thus subject to inertia errors. The author describes a photographic method for obtaining the necessary records. All that is needed is the attachment of flash-light bulbs to the parts requiring study and photographing the light track on a rotating drum covered with sensitised paper. The completed record takes less than 15 minutes to prepare.

The Space Time Recorder (F. N. M. Brown, *J. Aeron Sci.* (U.S.A.)).

INDIAN AIR FORCE

Its Growth and Development During Ten Years : Indian Officers Trained at Cranwell : Active Service in Burma

DURING the late 1920's plans for Indianising all branches of the Defence Forces of India began to bear fruit. These plans included an Indian Air Force Bill, which became the Indian Air Force Act when it was passed by the Indian Legislature in 1932. This Act provided for the setting up of an entirely new fighting service, the Indian Air Force, which was to consist only of Indians.

The first squadron of the Indian Air Force was formed with a Squadron Headquarters and one Flight on April 1st, 1933. The commanding officer and the N.C.O.s were lent from the Royal Air Force. The Indian officers were all trained at the R.A.F. College, Cranwell, and in R.A.F. units in Britain. The other ranks were recruited all over India and trained at the Aircraft Depot, Karachi.

Second Flight Formed

On April 1st, 1936, a second Flight was formed and the first Flight moved up to Peshawar, where, attached to No. 20 Squadron, R.A.F., it gained experience of Frontier warfare. During the Waziristan troubles in 1937 it was decided to send this Flight on active operations to Miranshah by way of an experiment. The Flight did extremely well and earned a high reputation for the Indian Air Force; it was congratulated by the Air Officer Commanding in India for carrying out a record number of operational flying hours during September, October and November, 1937. This proved not only the ability of the Indian pilots but also the competence of the Indian ground staff, who kept the aircraft flying without a single mechanical failure. This high standard of flying and maintenance has been kept up ever since by the Indian Air Force.

A third Flight was formed in April, 1938, and No. 1 Squadron moved as a complete unit to Ambala. Hitherto Flights had been commanded by seconded R.A.F. officers, but Indians now took over these commands. N.C.O.s above the rank of corporal were still British. Detachments of the Squadron have continually been involved in Frontier operations ever since 1937. The Squadron's primary duty was army co-operation, and detached Flights flew to places all over India to carry out training with Indian Army units.

Outbreak of War

On the outbreak of war in September, 1939, the Indian Air Force consisted of No. 1 Squadron. This Squadron had a number of very highly trained regular officers and airmen. The unit was then commanded by an Indian, and, except for a few warrant officers and senior N.C.O.s, the personnel were all Indians. The standard of flying and maintenance was extremely high. It was from this carefully developed and specially trained nucleus that the subsequent expansion of the Indian Air Force took place.

The first step was the formation of a Service Flying Training School, an Initial Training Centre, and a School of Technical Training. An expansion to four regular Squad-

The badge of the first Army Co-operation Squadron of the Indian Air Force. The motto "Ittehad Men Shakti Hai" means "In Unity there is Strength" and typifies the spirit of the I.A.F.

Pilots, mainly Bengalis, of the Indian Air Force, who took part in the Burma campaign.

Men of the Indian Air Force working on a Mercury VIII in a Blenheim.

INDIAN AIR FORCE

Engine fitters undergoing a special course of training at the Poona Engineering College. This course is part of a big scheme for training airframe and engine fitters.

An Indian wireless operator seated in front of his instruments. Equipment is of the standard pattern employed by the Royal Air Force.

rons and five independent Flights with a reserve of 300 pilots and 2,000 mechanics was the original aim. By the middle of 1941 this objective was in sight, and it was decided to have a further expansion to ten complete Squadrons with a continuous flow of pilots and mechanics by way of reserves. This has almost been achieved now, and it is also intended that the Indian Air Force should take over a considerable portion of the Royal Air Force ground organisation in India. In addition to all this a number of Indian pilots have been seconded for duty with the R.A.F. in England, and many of the first 24 so seconded saw service in the Battle of Britain.

Province Buys Planes

On October 19, 1941, a badge was presented to No. 1 Squadron, Indian Air Force, by Sir George Cunningham, the Governor of the North-West Frontier Province. This badge had been designed by an officer of the Squadron, passed by the Chester Herald (who is Inspector of Indian Air Force Crests), and approved by His Majesty the King. Shortly after this No. 1 Squadron became associated with the Bombay Presidency as this province raised enough money to buy aircraft to re-equip the Squadron. The motto of the Squadron, on the badge, is "Ittehad Men Shakti Hai"—In Unity there is Strength. "Ittehad" is Urdu (Persian), and "Shakti" is Hindi (Sanscrit). This motto typifies the spirit of the Indian Air Force, in which all feed at the same table—both physically and metaphorically.

Early in 1942 it was decided to send No. 1 Squadron on active service in Burma. With it went one of the new independent Flights (which later expanded into No. 353 Squadron, Indian Air Force). This decision was very much appreciated throughout the Indian Air Force. The personnel themselves in these units were thrilled and delighted.

An Indian fighter-pilot gets into his Hurricane with a gesture of confidence.

Paratroop training is one of side-shows of the I.A.F. A number of instructors have been lent by the R.A.F. to teach the proper method of jumping.

INDIAN AIR FORCE

The performances of both these Squadrons are now well known. It will suffice to say that the Indian Air Force kept up the high reputation it had already earned, and always maintained, and that it was congratulated by the Supreme Commander on its good work. It is interesting to recall here that both these Squadrons were commanded by Indians when on active service in Burma, and that No. 1 Squadron was completely and No. 353 Squadron almost completely manned by Indians.

India Guarded by I.A.F.

It must not be forgotten that the other Indian Air Force Squadrons, which had not been lucky enough to get a chance of actually going into action against the enemy, have been continuously employed in guarding the Indian coastline and the North-West Frontier. In fact these duties have been taken over entirely by the Indian Air Force. A very happy feature in the growth of the Indian Air Force has been the very close association and co-operation between it and the Royal Air Force in India. The two Services work in close harmony as "the Air Forces in India," and the personnel have a mutual respect and regard for each other.

During its short history the Indian Air Force has built up its own traditions. These are based partly on the ideas gained from the Royal Air Force, partly on the customs of the Indian Army (with which it works in co-operation), and, last but not least, partly on traditions of its very own. The nature of its duties, the absence of all religious and communal prejudices and the happy relations between officers and men combine to make it the Service which represents India of the future.

Indian airmen leaving their Fulmar after returning from a reconnaissance flight. The Fairey Fulmar makes an excellent reco. machine, since it is both roomy and well able to look after itself if attacked.

The presentation of a general badge and ensign by His Royal Highness the Duke of Gloucester, at Risalpur, N.-W. Frontier, recently, was an important event in the history of the Indian Air Force, and one that marks a further step forward in its career.

"The Time Has Come . . . ."

WHILE Spitfire pilots circled protectively above, a Walrus Air-Sea Rescue craft fought with heavy seas in the Channel to rescue a fighter pilot who had been drifting in his dinghy for thirty-seven hours.

The Walrus, piloted by a flight sergeant, found the fighter pilot still paddling in an endeavour to beat the wind and tide and make some headway towards England.

So rough was the sea, however, that the Spitfire pilots above, and the one hoping to be picked up, both felt that the rescue could not be made. But the Walrus pilot decided that something had to be done.

"I put my plane down, and, after bouncing off the waves two or three times, managed to alight. My gunner and I struggled and hauled the Spitfire pilot aboard our heaving aircraft, and then I was faced with the problem of getting the well-loaded Walrus into the air again.

"I made two attempts to get off, but all that happened was that we were badly knocked about by the heavy seas. We didn't fancy the idea of taxying to the French coast, so we had to keep on trying.

"I made another attempt. I opened the throttle wide and stuck to it. Then came the biggest shake-up I've ever had in my life. For more than half a mile we bounced off wave after wave, and after much heaving of the control column we finally bounced into the air—and stayed there.

"Then I discovered the compass had been shaken out of place by the buffeting, and I had to steer a rough course for home. When we sighted the English coast the rest was easy."

When the rescuers and rescued had been safely escorted to base by the Spitfires, the pilot who had been picked up, little the worse for his many hours in the dinghy, reported that his flight commander (now reported missing) had shot down an Fw190 before he himself was attacked by a number of Fws.

Coastal Command Carries On

THE search for submarines by the Royal Air Force is unceasing; day in, day out, patrol is kept over the Eastern Atlantic. In a recent month, Coastal Command made thirty attacks on U-boats in this area.

The majority of U-boat sightings now occur in the Bay of Biscay, where Admiral Doenitz' *Untersee* vessels run the gauntlet to and from French coastal waters.

For security reasons it is not possible to give exact figures or details of these attacks. The month quoted above was taken as an example of recent activity. To-day, both sightings and attacks have intensified.

Most of this work is done by squadrons of Sunderlands, Liberators, Wellingtons, Whitleys and Hudsons.

"F" for Freddie of a Liberator squadron made three attacks during this particular month, all within a few days of one another.

Another Liberator attacked two submarines within two hours.

"F" for Freddie caught one of the U-boats completely by surprise before it had time to crash-dive. Five men were in the conning-tower as the aircraft released four bombs.

"They straddled the U-boat," said one of the aircraft's crew. "After the explosion a large piece of metal was flung into the air about 50ft. and the whole submarine seemed lifted out of the water."

The submarine then apparently tried to submerge but, with the conning-tower only half-way under water, it suddenly rose again to the surface. Practically stationary, it leaked oil.

"F" for Freddie attacked once again, and this time the U boat sank slowly.

These Liberator aircraft set up the highest figures of U-boat attacks for any Coastal Command squadron for this period. A Hudson squadron ran a close second, one of its aircraft making three attacks.

It is sometimes possible to catch a U-boat off its guard and attack before the enemy realises his danger.

"H" for Harry of a Wellington squadron, on patrol over the Bay of Biscay, sighted a U-boat on the surface eight miles distant. He approached so carefully that the submarine did not sight the aircraft until it attacked. Three men in the conning-tower were machine-gunned as the Wellington swept over to drop its bombs.

Sunderlands have made many attacks on German submarines in the Bay of Biscay, although the Germans are attempting to protect the U-boats with an air umbrella of Arado floatplanes. Despite the Arado's heavy fire-power, the Sunderlands have beaten off many such attacks, and have to their credit a short-range fighter, a Messerschmitt 109.

Sometimes an enemy submarine will elect to fight it out on the surface, perhaps because mechanical trouble precludes a crash-dive, and a gun duel develops.

Recently the front and rear gunners of a Coastal Command aircraft raked a U-boat's deck and saw the bodies of two of the crew fall into the sea. But the enemy sent up replacements, and again the aircraft machine-gunned the enemy gun crews. This time three of them fell to the deck.

The enemy's increasing air protection for his U-boats in the Bay testifies to the challenge of Royal Air Force attacks in this area, where it is estimated that one in three U-boats crossing the Bay of Biscay is attacked.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

INTERNATIONAL AIR POLICE

Aircraft are More Than Long-range Guns

"GROUND FAIRY," who calls the airplane merely a long-range gun, seems to have forgotten that aircraft can also carry machine-guns and cameras, both very useful to the policemen's work, and that it can also carry policemen.

A police force, being charged with the duties of observation, prevention of crime, and pursuit of wrongdoers, must necessarily have the fastest means of transport and communication in its territory, whether local or international. It must also, though doing most of its work in a polite, friendly and unarmed condition, be backed by force strong enough to resist anything that may be brought against it, as our national police are backed up by troops in case of necessity.

Whether we shall establish an international police force is a matter to be decided. If we have one it must have as wide a variety of aircraft as a local police force has of ground transport.

L. TAYLOR,
(Secretary, Air League of the British Empire).

TRICYCLE UNDERCARRIAGES

A Word in Their Defence

JUST a few random thoughts on the tricycle versus bicycle undercarriage controversy.

One of the chief arguments usually made in support of the conventional variety is that it will be much lighter; but I beg to question this for the following reasons:

In the case of tricycle arrangement—

(*a*) The structure of the tail end of the fuselage can be much less substantial due to the absence of tail-wheel loads and tail shimmy (almost all tail wheels do shimmy—a fact often not taken into consideration). [So does the front wheel of a tricycle.—ED.]

(*b*) The very small yawing forces placed on the main wheels, due to the tricycle's non-swinging characteristics, enable them to be of lighter construction.

I have seen quite a number of undercarriages collapse, and in at least 90 per cent. of the cases this has been due to swinging during take-off or landing; almost never due to a heavy landing alone. That is why it is surely logical to assume that any undercarriage arrangement that overcomes this inherent vice will not only be safer but quite as light for the reasons stated above.

So far as tricycles are concerned, I can only speak from a theoretical point of view as I have never had the luck to fly one myself.

"PRO-TRIKE."

FLEET FIGHTER PERFORMANCE

Fire Power and Manœuvrability

IN looking over my current issue of *Flight* (September 3rd), I read with special interest the letter by J. H. on Fleet fighter performance. It happens that I, too, have a copy of the booklet *Ark Royal*, which is mentioned in the letter, and I distinctly remember the passage quoted. I must admit that I was rather mystified by its allusion to the superior speed of the Fiat C.R.42.

I can assure J. H. that the Fulmar is a very manœuvrable machine, as I have had the pleasure of watching it being put through its paces at an airfield near where I live. I do not say it is more manœuvrable than the Fiat; that would be impossible, but there is not a great deal of difference. Although I have seen no Fiats in action, I am certain that their powers of manœuvre would give them no decisive advantage, unless they were in greater numbers.

As to armament, I fail to see, even assuming the Italian to be faster and more manœuvrable, how it could make use of its advantage with only a very light volume of fire, especially as the Fulmar is now credited with a rear gunner as well as the eight wing guns.

The British machine would need less time to fire a heavy burst than the Italian. While the Italian's manœuvrability, being slightly better, would put it in an advantageous position, it certainly would not be able to hold it long enough to make the burst of fire a telling one.

Only if the pilot or the motor were hit would he have a good chance of success.

I am also quite aware that the guns carried by the Fiat are of rather larger bore than our own, but the fact that they are controlled by an interrupter gear, and that the Fulmar is undoubtedly of more robust construction, surely makes up for that.

Finally, the suggestion by J. H. that manœuvrability is worth six more machine-guns is, in my opinion, nonsense.

I need only refer to the Battle of Britain for the answer. Could we have "clawed down" the *Luftwaffe's* fighters and bombers with two-gun Hurricanes and Spitfires?

G. S. HENDERSON.

A HOME AIR GUARD

Educational Classes Suggested

LITTLE progress appears to have been made with the formation of a Home Air Guard. I would suggest that, if flying Home Guards are not a practical scheme, something could still be done by establishing educational classes for instructing in maintenance and ground staff duties. After passing their examinations the Home Guards could take turns at the airfields nearest to their homes. I feel that such a scheme would arouse interest among skilled workers, and it would have the advantage of training them for jobs which they might be called upon to perform in an emergency.

If this idea has not already been considered, I should like to see it put forward in *Flight* so that the views of readers could be ascertained.

G. R. BRANDRETH.

FORTRESS SQUADRON

Gun Turrets of the B.M.E.

NOW that details have been disclosed regarding the armament of the Fortress aircraft, Mark B-17E, I would refer to your article of August 20th in connection with a visit to a U.S. Army Air Corps unit stationed in Britain. There is one correction with regard to the armament which we think should be made. On page 204 you state that "some of the guns are in power-operated turrets—two in a Bendix dorsal turret and two in a Sperry spherical under the fuselage."

I have been in close touch with the Fortress aircraft in this country in use with the R.A.F., and to my knowledge both the power-operated turrets, known as the "mid-upper" and the "spherical ball," are of Sperry design, and use two 0.5in. guns. The other armament disposed around the aircraft is not of Sperry installation, but the two turrets referred to are both of Sperry design.

J. VIVIAN HOLMAN,
Manager, Aeronautical Department,
(For the Sperry Gyroscope Co., Ltd.)

ASTRO-NAVIGATION

Use of Solar Time Avoided

THE article referred to in Mr. C. B. Collins' letter published in your issue of August 27th was put together in the first place in order to make clear to my own and other simple minds the principles upon which navigation by the stars is based.

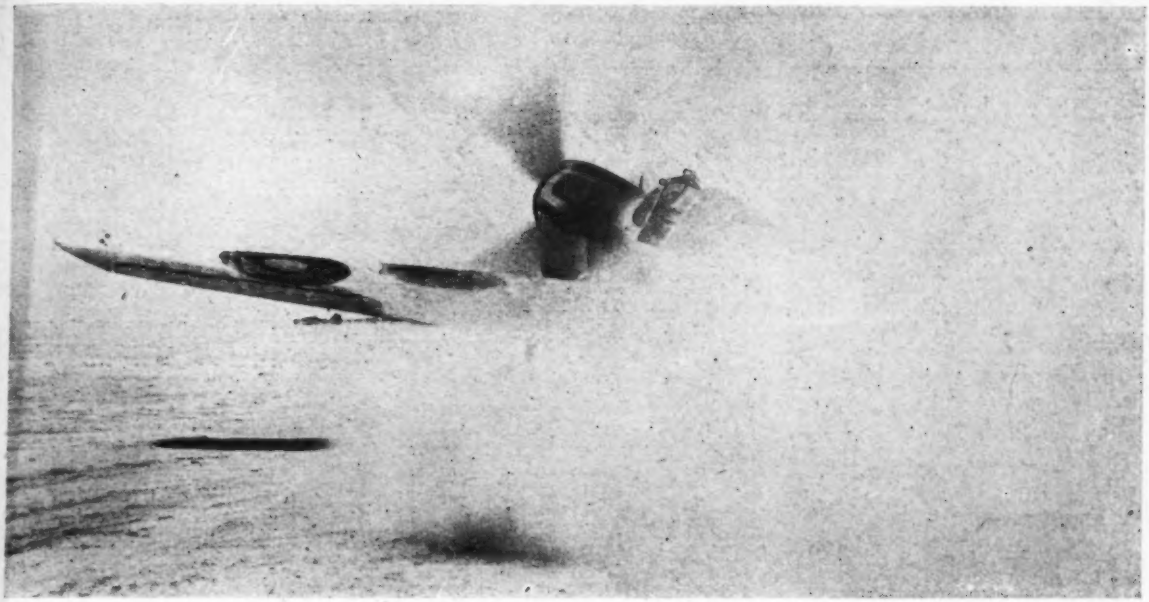
Particularly did I wish to avoid complication, such as must have arisen, for example, had the various ways of measuring time been discussed.

In the article I wrote that, in order to save work, the chronometer should be graduated in degrees instead of hours. This surely put emphasis upon what must have been evident to the initiated, viz., that my chronometer, preferably reading in degrees, was essentially a recorder of the angle by which Greenwich Meridian had passed the F.P. of A. at the time of making the observations. Call it siderial time if you like.

It may be objected that this would be unusual and that grandpapa didn't do it, but it is justified for it simplifies navigation.

One might ask why Mr. Collins assumed that we were using solar time for astronomical observations. The matter as set forth in this article is At at Lloyd's, copper fastened, and Mr. Collins' contention is invalid.

A. L. MIEVILLE.



Sand is the bugbear of all things mechanical which have to fight in the Western Desert. Here is a Kittyhawk making its own sandstorm as it takes off.

Service Aviation

Royal Air Force and Fleet Air Arm News and Announcements

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

BAR TO THE DISTINGUISHED FLYING CROSS.

Act. Flt. Lt. P. R. CASEMENT, D.F.C., No. 61 Sqn.—Flt. Lt. Casement is an outstanding captain and pilot. He has completed numerous operational missions, during which he has attacked highly important industrial targets in Germany; he has also completed several patrols over the Atlantic and has assisted in the destruction of a U-boat. Throughout his operational career, this officer has displayed great efficiency and devotion to duty which have proved a source of encouragement to his fellow captains.

DISTINGUISHED FLYING CROSS.

Act. Flt. Lt. C. THOMAS, R.A.F.V.R., No. 64 Sqn.—This officer has participated in numerous sorties over enemy territory. He has led his section with much success and, by his skill and splendid example, has proved a source of encouragement.

F/O. K. J. RIDDY, R.A.F.V.R., No. 240 Sqn.—In June, 1942, this officer was the captain of a Catalina flying boat which, whilst engaged on an anti-submarine patrol in the Mediterranean, was detailed to act as escort to one of His Majesty's ships. During the operation seven triple-engined enemy aircraft, accompanied by four fighters, were observed approaching to attack. Displaying great courage and resource, F/O. Riddy engaged the enemy and, despite the great odds, broke up the formation before the attack could develop. Later, his aircraft was attacked by the four fighters, but F/O. Riddy, skilfully manœuvring his aircraft, enabled his gunners to beat off the attackers by well-controlled fire. Although his flying boat was damaged and the wireless operator wounded, this officer continued his escort duty until he was eventually compelled to abandon it owing to lack of fuel. During this sortie F/O. Riddy displayed coolness and determination in the face of great odds.

P/O. A. R. A. HUNT, R.A.F.V.R., No. 502 Sqn.—P/O. Hunt was captain of an aircraft on patrol when he observed a U-boat. Displaying great promptitude, resource and skill, he immediately dived and delivered an accurate attack.

F/O. R. B. INGALLS, R.C.A.F., No. 142 Sqn.—As air observer, F/O. Ingalls has participated in numerous operational sorties over enemy and enemy-occupied territory. His coolness in the face of the heaviest defences has contributed materially to the successes obtained. Unperturbed whatever the circumstances, he shows the greatest determination to locate and bomb his objective. He always endeavours to impart his knowledge to those with less experience.

F/O. C. R. JACOBS, R.A.F.V.R., No. 150 Sqn.—This officer has participated in attacks on various targets in enemy and enemy-occupied territory, including Mannheim, Lubeck, St. Nazaire, Cologne and Essen. On one occasion whilst over Cologne, his aircraft was hit by anti-aircraft fire, which severed the hydraulic system. Despite the fact that the undercarriage and bomb doors were hanging down he completed his run and successfully bombed his objective. On the return to base he executed a faultless crash landing. On another occasion in June, his aircraft was attacked by a night fighter. The aircraft was damaged and the blind flying panel was rendered useless. Displaying skilful captaincy and airmanship, F/O. Jacobs extricated his aircraft from a most perilous situation. On returning to base he completed a perfect crash landing. This officer possesses a high degree of courage, skill and initiative.

Wing Cdr. F. D. S. Scott-Malden, D.S.O., D.F.C. and Bar, who has been awarded the Norwegian Cross by King Haakon. He led the Norwegian Wing in the Dieppe raid.

F/O. W. C. LANGSTAFF, R.C.A.F., No. 150 Sqn.—As air observer, this officer has been engaged on operational flying since August, 1941. He has completed numerous sorties, including an attack on a target in Italy and a daylight attack against the German warships at sea. On one occasion in March, 1942, his wireless equipment became unserviceable whilst crossing the English coast on the outward journey to Cologne. Despite this, he successfully navigated his aircraft to the target and back to this country where a safe landing was made. His ability to navigate in extremely bad weather has contributed materially to the successes obtained. His coolness, co-operation and devotion to duty have set a praiseworthy example.

F/O. D. J. H. MALTBY, R.A.F.V.R., No. 97 Sqn.—As captain of aircraft F/O. Maltby has set and maintained an extremely high standard of ability. He has taken part in sorties covering a wide variety of important enemy targets, such as Essen, Trondheim, Warnemunde, Kiel and others. On one occasion he was specially detailed to perform a very important mining operation in adverse weather. The conditions were such that only by his great skill and determination was he able to complete the mission successfully. He has set a very fine example.

F/O. B. PEEL, R.C.A.F., No. 9 Sqn.—As air observer this officer has been engaged on operational flying since August, 1941. His navigational skill has been of the highest standard. He has participated in sorties against a wide variety of enemy targets, including Berlin, Essen, Cologne, Rostock, Hamburg and Kiel. One night in April, 1942, he was navigator of an aircraft detailed to attack the Ruhr. During the operation his aircraft was subjected to heavy enemy fire whilst held in a concentration of searchlights. F/O. Peel's clear directions to his captain enabled him eventually to evade the defences. On another occasion his aircraft was caught in a searchlight belt and heavily fired upon for about a quarter of an hour when approaching a target in the Ruhr. In the face of a hazardous situation he successfully navigated the aircraft to the target and released his incendiary bombs within one minute of the allotted time. In an attack on Nurnberg he navigated his aircraft to and from the target area; this necessitated flying in cloud for some four hours. F/O. Peel has displayed great devotion to duty.

SERVICE AVIATION

P/O. W. J. O'CONNELL, R.C.A.F., No. 226 Sqn.

P/O P. SAUNDERS, R.A.F.V.R., No. 226 Sqn.—On May 7th, 1942, P/O. O'Connell and P/O. Saunders were pilot and observer respectively of the leading aircraft of a formation of six bomber aircraft detailed to attack the power station at Ostend. Despite bad weather P/O. Saunders skilfully navigated his pilot to the target area where severe opposition from the ground defences was encountered. All the aircraft of the formation were hit, but P/O. O'Connell, continuing his bombing run, enabled his navigator to bomb the objective and succeeded in withdrawing the formation intact. On two previous occasions (the first after attacking and sinking a 7,000-ton supply ship and the second after a highly successful attack on a ship at Le Havre) his aircraft was severely damaged. Each time P/O. O'Connell flew his aircraft back to base and, with the hydraulics shot away carried out landings with the undercarriage retracted. Both these officers flew together in an aircraft which was detailed to attack the Matford factory at Poissy on March 8th, 1942. They have at all times displayed the highest devotion to duty and the keenest determination to achieve success.

F/O. T. B. STONEY, R.A.F.V.R., No. 58 Sqn.—This officer commenced operational flying in June, 1941. During the period he has attacked targets at Berlin, Kiel, Bremen, Cologne, Hamm, Hamburg and many other heavily defended areas. He has invariably pressed home his attacks with great determination. His courage, keenness and ability have set a very fine example to all.

Act. F/O. A. S. ALDRIDGE, No. 18 Sqn.—This officer fought in France in May, 1940, and took part in numerous sorties involving attacks on barges and troop concentrations. On his return to this country he carried out a number of sorties including North Sea sweeps, convoy escorts and attacks on targets in the Low Countries and Germany. Many of these sorties were completed in extremely bad weather. F/O. Aldridge joined his present squadron in July, 1941, and has continued his excellent work. In July, 1941, he participated in an attack on a convoy off Ymuiden. Hits were scored on a merchant ship of 6,000 tons. He also took part in an attack on shipping in the docks at Rotterdam on 16th July and in an attack on the power station at Gosnay on 21st September, 1941. During a period of attachment to Malta, F/O. Aldridge completed a number of sorties. In one of these, against shipping in Tripoli Harbour, his aircraft was attacked by Italian fighters; he was wounded in the back, but in spite of this he navigated the aircraft successfully back to Malta. This officer has always displayed the greatest courage and determination.

Act. F/O. G. M. DAVIES, R.N.Z.A.F., No. 12 Sqn.—For the past three months F/O. Davies has acted as chief navigation officer in addition to his flying duties. He has participated in numerous raids since November, 1941, including such heavily defended targets as Wilhelmshaven, Brest, Hamburg, Kiel and Essen. His navigation is invariably of the highest order, while his determination to ensure accurate bombing has been most notable. He has set a courageous example.

Act. F/O. D. S. GIBB, R.N.Z.A.F., No. 149 Sqn.—This officer has participated in numerous attacks on the enemy's industrial targets, shipping and dockyard installations. He is an excellent captain of aircraft and has carried out his tasks with great thoroughness and determination. By his own excellent example he has instilled his aircraft, crew with a fine fighting spirit which has been largely responsible for the successes obtained. He has displayed great courage and devotion to duty.

Act. F/O. J. WELCH, No. 18 Sqn.—F/O. Welch is an extremely efficient air gunner. He fought in the Battle of France and took part in many sorties. Since his return to this country he has participated in a large number of sorties, including North Sea sweeps, convoy escorts and attacks on targets in the Low Countries and Germany. In November, 1940, whilst over Holland, severe weather was experienced, which rendered most of the aircraft's instruments, including the wireless equipment, unserviceable. F/O. Welch skilfully repaired the wireless and enabled his pilot to obtain bearings which eventually resulted in the safe return of the aircraft to base after five hours flying in extremely adverse conditions. In July, 1941, he took part in a very successful attack on an enemy convoy off Ymuiden. On 21st September, 1941, he participated in an attack on the power station at Gosnay.

P/O. J. E. CASEY, R.N.Z.A.F. (since deceased), No. 9 Sqn.—On one occasion P/O. Casey was detailed to release incendiary bombs over a target at Essen. Some 15 minutes before the allotted time for releasing his bombs, his aircraft was held in a concentration of searchlights and subjected to heavy anti-aircraft fire. Determined to release his bombs at the appointed height, P/O. Casey flew on in the face of intense opposition until he had nearly reached his target. He then skilfully evaded the defences and released his bombs at the correct height within a few moments of the allotted time. On another occasion, during the return journey from Dortmund and whilst still over the Ruhr area, his aircraft was caught in a belt of searchlights and subjected to a heavy barrage at about 15,000 feet. He eventually evaded the defences by descending to 5,000 feet and, although a petrol tank was apparently damaged as the gauges registered a much smaller amount than there should have been, he flew the aircraft safely back to base. This officer, who has participated in numerous sorties over heavily defended targets, has shown exceptional eagerness to undertake any task. He has been most conscientious in all his operational undertakings.

P/O. A. W. G. COCHRANE, R.N.Z.A.F., No. 150 Sqn.—This officer is employed as captain of aircraft. Throughout he has completed his attacks with skill, courage and determination. On one occasion in March, 1942, his aircraft would not climb above 1,000 feet. Despite strong enemy opposition and the presence of balloons P/O. Cochrane, with great resolution, flew on and successfully bombed his objective at Essen. His aircraft was damaged by anti-aircraft fire. His high devotion to duty is shown by the completion of six successful night sorties between 30th March and 7th June, 1942. His fearlessness in the face of danger has inspired a high standard of morale in his crew. P/O. Cochrane has attacked many important enemy targets, including Brest, Cologne, Bremen and Hamburg.

P/O. A. W. DOUBLEDAY, R.A.A.F., No. 460 Sqn.—Throughout his operational career this officer has shown outstanding ability, coupled with a strong sense of duty. On a number of occasions he has pressed home his attack from a low altitude with complete disregard of enemy opposition. He has acted as captain of aircraft on 22 occasions. Amongst the numerous objectives he has attacked are Emden, Le Havre, Cologne, Rostock, Essen and Kiel.

P/O. P. S. DUFF, R.N.Z.A.F., No. 106 Sqn.—This officer has been navigator and later second pilot. As a navigator-bomb aimer his work was exemplary. On one occasion in the winter of 1941, his brilliant navigation in appalling weather conditions ensured the success of a mining operation. He has taken part in three daylight operations, two of which were low level attacks on targets well inside Germany. On these occasions he scored hits with his bombs and then used his beam gun most effectively. Since qualifying as captain of a Manchester he has completed several sorties, including the "thousand" raids on Cologne and Essen. P/O. Duff's courage and zeal are of a high order; his keenness is now being demonstrated in heavy bombers.

P/O. G. P. FOWLER, R.C.A.F., No. 419 (R.C.A.F.) Sqn.—This officer is employed as air observer. Since August, 1941, he has participated in numerous sorties involving attacks on important industrial targets in the Ruhr and dockyard installations both in Germany and German occupied territory. Throughout, his work has been extremely accurate, and has contributed materially to the many successes obtained. P/O. Fowler took part in the raids on Lubeck and Rostock and in the attack on the German warships in the English Channel.

P/O. J. M. GARLICK, No. 12 Sqn.—This officer has taken part in attacks on a wide range of enemy targets, including most of the heavily defended areas. He invariably shows the greatest determination to press home his attack whatever the opposition. His fearlessness and devotion to duty have set an excellent example.

P/O. W. GREEN, R.A.F.V.R., No. 7 Sqn.—This officer has performed excellent work in the role of navigator-bomb aimer. In the course of many sorties he has attacked most of the important enemy targets, including Berlin, Cologne, Essen, Hamburg, Kiel and Rostock. One night in June, 1942, he was the observer of a heavy bomber detailed to attack the Ruhr. Shortly after the take-off his captain was taken ill. With great initiative, P/O. Green took over the controls and on instructions from his captain flew the aircraft to within 20 miles of the Dutch coast. When this point was reached the captain had not recovered in any way, and P/O. Green was instructed to fly back to base. This he accomplished and the captain managed to make a safe landing. This officer has set a very good example.

P/O. R. T. HOLLAND, No. 207 Sqn.—As observer, P/O. Holland has completed numerous sorties over enemy territory, often under the most trying conditions. His constant reliability as a navigator and the accuracy of his bombing have been admirable. He has displayed great devotion to duty.

P/O. H. G. U. HUCKINS, No. 18 Sqn.—This officer has been engaged on operational flying over a long period. He fought in the Battle of France, completing many sorties. On return to this country, he took part in many North Sea sweeps and in an attack on Hamburg and another on Cologne. On one occasion the aircraft in which he was flying was shot down when attacked by three enemy fighters. In August, 1941, P/O. Huckins joined his present squadron and completed several sorties before proceeding to Malta with the unit. Whilst based at Malta he carried out a number of sorties, including a low-level attack on the Castelvetrano airfield in Sicily. The operation was carried out in the face of very heavy defensive fire and great success was achieved. This officer has at all times proved himself a most efficient and determined navigator and bomb aimer.

P/O. E. A. HUDSON, R.A.A.F., No. 57 Sqn.—This officer has carried out sorties against the majority of important enemy targets such as Brest, Hamburg, Kiel, Cologne and Rostock. He has at all times displayed great gallantry and devotion to duty even in the face of the most formidable of the enemy's anti-aircraft defences. His attacks have invariably been pressed home with the utmost vigour at a low height. His tremendous enthusiasm for operational flying, combined with his ability as a pilot and captain, have welded his crew into one of the most effective. Only once has a sortie been abandoned, and this only in the face of the greatest difficulties.

P/O. A. R. KENDRICK, No. 18 Sqn.—This officer has participated in reconnaissances and attacks on enemy airfields, industrial targets, shipping and invasion ports. He is a very experienced navigator, who performs his duties with zeal and efficiency. On August 21st, 1941, he took part in a low-level attack on the ironworks at Ymuiden. On February 12th, 1942, he navigated the leading aircraft of a small bomber force which attacked the German warships at sea. Throughout, his navigation and bombing ability have been of a high standard.

P/O. J. KING, No. 18 Sqn.—As wireless operator/air gunner this officer has completed many sorties, involving attacks on enemy airfields, shipping, barge concentrations and industrial targets. On many of these sorties he has acted as gunnery leader, a duty which he has skilfully performed. His ability both as a gunner and wireless operator have set an excellent example.

P/O. A. R. A. MACLACHLAN, R.A.F.V.R., No. 156 Sqn.—This officer is employed as captain of aircraft. Throughout the numerous sorties in which he has participated he has displayed exceptional tenacity and has pressed home his attacks with the utmost vigour. He has on two occasions been attacked by an enemy fighter, but his skilful manœuvring enabled his gunner to shoot one of them down in flames and probably destroy the other. Amongst many of the enemy targets he has attacked are such important places as Brest, Cologne, Hamburg, Essen and Rostock.

P/O. W. J. PICKEN, R.A.F.V.R., No. 106 Sqn.—This officer has acted as captain on Hampden, Manchester and Lancaster aircraft. He is a pilot of great skill and resource who has achieved much success. He has many times attacked targets in the Ruhr and on several occasions bombed the naval yards of Hamburg, Kiel, Bremen and Brest. He took part in the attack on the Renault armament factory, scoring hits from 3,000 feet. He invariably presses home his attacks whatever the opposition. His courage and determination have been of a high standard.

P/O. J. A. SINCLAIR, R.A.F.V.R., No. 15 Sqn.—This officer is employed as navigator on heavy bomber aircraft. He has participated in a large number of sorties, including attacks on such heavily defended areas as Berlin, Brest, and targets in the Ruhr. He has also taken part in daylight attacks on Lille and La Rochelle and has navigated his aircraft to such long-range targets as Genoa, Turin and Pilsen. Throughout a long and successful tour of operations P/O. Sinclair has displayed a high degree of skill and courage.

P/O. D. E. SULLIVAN, R.A.F.V.R., No. 9 Sqn.—As air gunner this officer has taken part in sorties over enemy and enemy-occupied territory, including the heavily defended areas of Brest, Hamburg and Wilhelmshaven. On one occasion he was the rear gunner of an aircraft detailed to attack Essen. Whilst over the target area the aircraft was attacked by an enemy fighter. In the ensuing engagement P/O. Sullivan's aircraft was severely damaged. Despite this, bombs were released at 4,000 feet. The damaged aircraft lost

Gen. Adler, of the U.S. Army Air Force in the Middle East, about to enter a transport machine with his secretary.

height and, in particularly harassing circumstances, the captain warned his crew to stand by ready to abandon aircraft. Meanwhile, P/O. Sullivan kept up a running commentary on all that was happening from his point of view and thus considerably heartened the other members of the crew. This officer is an excellent air gunner; his tactical knowledge is above the average. On one operational flight his skilful directions enabled his captain to evade enemy fighters on five different occasions. His efficiency and drive have set an excellent example.

P/O. W. H. THOMPSON, R.A.F.V.R., No. 460 Sqn.—This officer has displayed a high degree of skill and initiative throughout his operational career. His skilful navigation has contributed in a large way to the successful conclusion of the numerous sorties in which he has participated. One night in May, 1942, he was navigator of an aircraft which was severely damaged by enemy fire. His co-operation, coolness and devotion to duty were of great assistance to his captain in difficult circumstances.

Act. Flt. Lt. W. ASTELL, R.A.F.V.R., No. 143 Sqn.—One night in May, Flt. Lt. Astell was captain of an aircraft which carried out an attack on an enemy landing ground. Following the attack his aircraft was intercepted and damaged by an enemy fighter. The rear turret and rudder control were rendered unserviceable, whilst fire broke out in the fuselage. The starboard wing, the engine nacelle and an ammunition container also caught fire, and two members of the crew were wounded. The aircraft lost height, and Flt. Lt. Astell ordered his crew to escape by parachute. Two of them were able to do so, but time did not permit of similar action being taken by the navigator and Flt. Lt. Astell. The latter was able to make a successful crash landing, however, and both he and his colleague managed to extricate themselves from the wreckage.

After a period of five days, fraught with danger, they eventually observed one of our patrols. Flt. Lt. Astell went forward to make contact but, unfortunately, was unable to do so. He returned to the place where he thought he had left his colleague but he could not find him. Flt. Lt. Astell eventually discovered another friendly detachment and reached safety. Throughout the engagement, and subsequently, this officer displayed great courage and fortitude.

Act. Flt. Lt. M. FOULIS, R.A.F.V.R., No. 38 Sqn.—In June 1942, this officer captained an aircraft which participated in an attack on an Italian naval force. Despite poor visibility, and in the face of an intense defensive barrage, he courageously pressed home his attacks from a very low altitude. His complete disregard of danger and his determination set a splendid example. This officer has completed numerous sorties and he has invariably displayed daring of a high degree.

Act. F/O. F. J. HIGHAM, R.A.F.V.R., No. 68 Sqn.—This officer has participated in the destruction of four enemy aircraft; one other has been damaged. He displays great devotion to duty and is always keen to engage the enemy.

P/O. J. R. DUDLEY, R.A.F.V.R., No. 37 Sqn.—One night in July, 1942, this officer participated in an attack on Tobruk. In spite of heavy and accurate anti-aircraft fire he made repeated runs over the target area and his work facilitated the attacks made by following aircraft. His aircraft was severely damaged by enemy fire but, displaying skilful airmanship, he succeeded in flying it safely back to one of our landing grounds where he made a safe landing. Throughout the operation this officer displayed great courage and determination to accomplish his task. On a previous occasion, P/O. Dudley displayed great courage when he vigorously attacked Tobruk from a height of 1,500 feet.

P/O. A. H. THOM, R.A.F.V.R., No. 87 Sqn.—This officer has been engaged on operational flying for a long period both by day and by night. Throughout he has displayed great keenness and devotion to duty. He has destroyed two enemy aircraft, both of which he shot down after pursuing them out to sea for more than 50 miles. On one occasion he engaged a He. 111 in extremely hazardous flying weather and probably destroyed it. Recently, P/O. Thom has completed several successful intruder operations. He has invariably displayed initiative and courage.

Act. Sqn. Ldr. R. E. E. MORROW, R.C.A.F., No. 402 (R.C.A.F.) Sqn—This officer has completed many operational sorties. His brilliant leadership and skill have contributed materially to the high standard of efficiency and fighting spirit of his squadron. On one occasion he led the squadron in a low-level attack on five enemy destroyers; one of them was believed to have been sunk, while the remainder were damaged. Sqn. Ldr. Morrow has destroyed one and assisted in the destruction of another hostile aircraft.

P/O. T. E. W. HOWES, R.A.A.F., No. 70 Sqn.—P/O. Howes was the navigator of an aircraft which attacked a concentration of enemy vehicles and motor transport in the Ras El Kanyis area one night in June, 1942. Whilst attacking at 2,000 feet, a burst from the guns of a hostile aircraft caused a complete failure of all lighting, and rendered the inter-communication system unserviceable, while the interior became full of smoke. Using the handle of his illuminated compass as a torch, P/O. Howes went aft to ascertain the damage. He found the second pilot and the wireless operator, both of whom were wounded, and assisted them to the cabin.

Flames from an electric resistance were spreading up the walls of the cabin, but P/O. Howes eventually extinguished them by disconnecting the accumulators. Making his way to the rear turret, which was on fire, he found the rear gunner severely wounded and with his clothing alight. He extinguished the gunner's burning clothing; then, with some slight assistance, he succeeded in extricating him from the turret. It was then seen that the gunner's left leg had been severed. P/O. Howes gave him an injection of morphia and endeavoured to apply a tourniquet. In the most harassing circumstances this officer displayed great courage and devotion to duty.

P/O. D. O. ROHDE, R.A.F.V.R., No. 115 Sqn.—One night in July, 1942, this officer was captain of an aircraft detailed to attack Saarbrucken. The target area was obscured by heavy cloud, but P/O. Rohde, determined to release his bombs over the target, immediately flew down through the cloud. In spite of considerable opposition from the ground defences, he eventually located the target and pressed home his attack from 3,000 feet. This officer also took part in an attack on Hamburg, during which he showed great skill and determination. P/O. Rohde has completed numerous sorties, mainly against heavily defended targets, and has set a fine example.

Flt. Lt. A. J. SIMPSON, No. 6 Sqn.—In June, 1942, this officer led a fighter formation in an attack on a large number of enemy armoured vehicles in the Bir Hacheim area. Although he was wounded in the chest by enemy ground fire, he continued to attack and obtained several hits on the objective. Although weakened by the loss of blood, and with his right arm useless, he attempted to gain height and evade the heavy barrage, but his aircraft was hit. Hot oil sprayed over his face and, being unable to see owing to smoke which was penetrating into the cockpit, he was forced to leave his aircraft by parachute at about 500 feet. Flt. Lt. Simpson descended safely, however, and was rescued by one of our ambulance units. Throughout, he displayed great gallantry and outstanding devotion to duty.

Act. Flt. Lt. D. J. M. BLAKESLEE, R.C.A.F., No. 133 (Eagle) Sqn.—This officer has completed a large number of sorties over enemy territory. He has destroyed one, probably destroyed two, and damaged several more hostile aircraft. He is a fine leader whose keenness has proved most inspiring.

Act. Flt. Lt. R. L. SPURDLE, No. 91 Sqn.—This officer is a keen and determined pilot. He has destroyed five, probably destroyed four, and damaged several more enemy aircraft. His devotion to duty has set a praiseworthy example.

Act. Flt. Lt. E. D. GLASER, R.A.F.V.R., No. 234 Sqn.—This officer has participated in 51 sorties. His excellent leadership, keenness and determination have set a worthy example.

P/O. R. J. G. GREEN, R.A.F.V.R., No. 156 Sqn.—One night in July this officer was captain of an aircraft which attacked Hamburg. On the return flight, near Bremen, his aircraft was held in a cone of searchlights. Displaying great resource, P/O. Green dived his aircraft down the searchlight beams from 13,000 to only 50 feet, thus enabling his front gunner to extinguish two of the lights. During the dive the aircraft was hit by shell fire. P/O. Green was wounded in the thigh, while the front gunner and the wireless operator received wounds in the arm and hand respectively. Despite great pain and the difficulty of controlling his damaged aircraft, P/O. Green skilfully flew it through a continuous barrage of anti-aircraft fire and searchlights until the coast was reached. Handing over the controls to the second pilot, he continued to direct his crew, although in a state of collapse. By his skill, courage and fortitude, P/O. Green was mainly responsible for the safe return of his aircraft and its crew.

Flt. Lt. W. R. GREENSLADE, A.F.C., No. 149 Sqn.—One night in July, 1942, this officer was captain of an aircraft detailed to attack Hamburg. Whilst over the target area the aircraft was held in the beams of searchlights and subjected to heavy anti-aircraft fire. One engine was put out of action and the astro-hatch shattered. In spite of this, Flt. Lt. Greenslade pressed home his attack. On the return flight, searchlight positions and gun emplacements were machine-gunned from a low level. This officer, who invariably completes his operational tasks with skill and determination, displayed great devotion to duty throughout.

F/O. J. R. STERNE, R.C.A.F., No. 174 Sqn.—This officer has displayed a fine fighting spirit, which, combined with his complete disregard of danger, has won the confidence and admiration of his fellow pilots. He has secured notable successes in night bombing attacks on enemy shipping. In one period of three nights, when operating alone against shipping, he destroyed a 4,000 ton ship which was heavily defended by some twelve escort vessels, and damaged several armed ships with machine gun fire; he has also assisted in the destruction of a 1,200 ton enemy coaster in daylight.

P/O. D. J. CURTIN.—One night in July, 1942, this officer was captain of an aircraft detailed to attack a target in North West Germany. When nearing the target area his aircraft was intercepted by an enemy fighter, but P/O. Curtin safely evaded it and flew on to the objective. Shortly after leaving the target area his aircraft was again intercepted by enemy fighters. In the ensuing engagement the rear gunner and wireless operator were badly wounded.

P/O. Curtin was almost blinded by cordite from a bursting shell, and the aircraft lost height by several thousand feet before the captain was able to clear his eyes and regain control. Later, when nearing the Dutch coast, the bomber was hit by fire from the ground defences; the navigator sustained wounds and the aircraft was damaged. Despite this, P/O. Curtin flew on and eventually reached this country. In difficult circumstances he made a safe landing in a field. Afterwards he assisted his wounded crew from the aircraft and then went off for further help. In this, his first operational flight, P/O. Curtin displayed great courage and determination.

Air Marshal W. A. Bishop, who is back in Britain again to visit the Royal Canadian Air Force. As a fighter pilot in the last war Air Marshal Bishop won the V.C., D.S.O. and Bar, M.C., D.F.C., and Croix de Guerre with two palms.

P/O. J. B. HIGHAM, R.C.A.F., No. 419 (R.C.A.F.) Sqn.—One night in July, 1942, this officer was captain of an aircraft which attacked Duesseldorf. When approaching the target area one engine of his aircraft failed and caught fire. Despite this, P/O. Higham resolutely flew on and successfully bombed the target in the face of considerable opposition from the ground defences. On the return flight the aircraft began to lose height, until P/O. Higham ordered certain equipment to be jettisoned. He was thus able to maintain height at some 2,000 feet, and eventually succeeded in flying the damaged aircraft back to a base in this country, where he made a skilful landing. Throughout, this officer displayed great determination and devotion to duty.

BAR TO DISTINGUISHED FLYING MEDAL.

Flt. Sgt. K. H. L. HOUGHTON, D.F.M., No. 207 Sqn.—Since being awarded the D.F.M., Flt. Sgt. Houghton has carried out many operational flights. He has displayed great initiative, courage and resolution throughout, and especially on one hazardous mission which was successfully completed.

Sgt. G. F. BEURLING, D.F.M., No. 249 Sqn.—Since being awarded the D.F.M. in July, 1942, Sgt Beurling has destroyed a further nine enemy aircraft, bringing his victories to 17. One of his exploits was the destruction of four enemy fighters in one day; during these brief combats he also damaged a further two hostile aircraft. His courage and determination are a source of inspiration to all.

DISTINGUISHED FLYING MEDAL.

Sgt. H. E. DE MONE, R.C.A.F.—In June, 1942, this airman was the rear gunner of an aircraft which successfully attacked Essen. On the return flight the aircraft was held in a cone of searchlights and attacked by an enemy fighter and was extensively damaged. Sergeant De Mone, who was engaged on his second operational mission, displayed exceptional courage and resource.

Sgt. H. A. MCLENNAN, No. 156 Sqn.—One night in July, 1942, this airman was the wireless operator of an aircraft detailed to attack Duisburg. When nearing the target area, the pilot was compelled to dive the aircraft violently, and Sgt. McLennan was thrown from his position in the astro-hatch. A box of incendiary bombs broke loose from its stowage, and the con-

SERVICE AVIATION

tents were scattered in the rear of the aircraft. One of the bombs became ignited, setting a further one alight and filling the aircraft with sparks and smoke.

With his bare hands Sgt. McLennan picked up one of the blazing bombs and endeavoured to throw it out through the escape hatch. He was unable to open the hatch, but with great presence of mind he pushed the burning bomb through the fabric of the fuselage. In spite of burns to his hands, he picked up the remaining bomb and disposed of it in a similar manner. By his prompt and courageous action this airman averted an extremely serious situation.

Flt. Sgt. P. E. GATEHOUSE, No. 248 Sqn.—One evening in August, 1942 an attack by a formation of our aircraft was made on two airdromes in Sardinia. Flt. Sgt. Gatehouse, who was the navigator of the leading aircraft, skilfully navigated the formation to the target, which was reached exactly at the right time to deliver a telling attack. A large number of hostile aircraft on the ground were destroyed and damaged. The safe return of his aircraft, involving a flight of some 400 miles at night, was accomplished mainly as a result of his accurate work. During the next day his aircraft was attacked by enemy fighters on five occasions, but his cool directions enabled his pilot to evade the attacker each time. Flt. Sgt. Gatehouse has displayed great gallantry and devotion to duty.

Flt. Sgt. R. C. GLEW, No. 277 Sqn.—Flt. Sgt. Glew served in the campaign in France, where he flew with great distinction. Since his return to this country he has completed many rescue patrols, and the aircraft in which he has flown, as air gunner and observer, have been instrumental in saving 17 members of air crews from the sea. On one occasion he participated in the rescue of five of the crew of a bomber, near the French coast, whilst under fire from the shore defences. This airmen has displayed great keenness and devotion to duty.

THE KING has been graciously pleased to approve the following awards:—

AIR FORCE CROSS.

Wing Cdr. T. F. U. LANG.
Wing Cdr. G. F. MACPHERSON.
Sqn. Ldr. R. P. BUCKNALL, R.A.F.O.
Sqn. Ldr. R. M. COX.
Sqn. Ldr. L. E. DALRYMPLI, R.A.F.O.
Sqn. Ldr. H. M. FERREIRA, R.A.F.V.R.
Sqn. Ldr. J. C. HARCOMBE, R.A.F.O
Sqn. Ldr. O. T. HAZELL, R.A.F.O.
Sqn. Ldr. F. W. MOXHAM, R.A.F.O.
Sqn. Ldr. H. A. ROXBURGH, R.A.F.O.
Sqn. Ldr. P. A. TIPPING.
Act. Sqn. Ldr. J. W. BURMAN, R.A.F.V.R.
Act. Sqn. Ldr. J. A. GORDON.
Flt. Lt. R. L. AMOR.
Flt. Lt. H. C. BARSON, R.A.F.V.R.
Flt. Lt. J. S. W. BIGNAL, R.A.F.V.R.
Flt. Lt. E. BRADLEY, R.A.F.O.
Flt. Lt. R. BURCH.
Flt. Lt. J. F. B. CAREY.
Flt. Lt. H. B. HARRIES.
Flt. Lt. G. HOWARD, R.A.F.V.R.
Flt. Lt. J. L. HUBBARD, R.A.F.V.R.
Flt. Lt. L. E. SEXSTONE.
Act. Flt. Lt. W. A. M. BIRT, R.A.F.V.R.
Act. Flt. Lt. F. H. GLEDHILL, R.A.F.V.R.
F/O. A. L. COLLETT.
F/O. A. EDWARDS, R.A.F.V.R.
F/O. D. L. GROUT.
W/O. E. J. JOHNSON.

AIR FORCE MEDAL.

Flt. Sgt. J. G. MILLAR.
Flt. Sgt. (now P/O.) J. A. MITCHELL.
Flt. Sgt. T. A. E. TOBIAS.

The above officers and airmen have shown outstanding ability and devotion as flying instructors and have been a source of inspiration to their pupils.

Roll of Honour

Casualty Communique No. 153.

THE Air Ministry regrets to announce the following casualties on various dates. The next-of-kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Royal Air Force

KILLED IN ACTION.—Sgt. J. Alexander; P/O. L. J. R. Back; P/O. L. W. Bangley; P/O. W. E. Coates; Flt. Sgt. R. E. R. Cotton; Sgt. G. M. Culley; P/O. A. McG. M. Mitchell; P/O. D. L. Muir; Sgt. A. Sackman; Flt. Lt. C. B. Temlett, D.F.C.; Sgt. J. Weatherall; Sgt. J. Weston; W/O. G. S. Wilson, D.F.M.

Plan view of a Martin Baltimore. The entire nose of the Baltimore, including the strengthening ribs, is of clear plastic material.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. R. V. W. Walker; Sgt. J. H. Woolman.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. P. Drummond-Hay; Sgt. K. Elkins; Sgt. B. Howells; Sgt. R. M. Porter; Sgt. J. A. Redfearn.

WOUNDED OR INJURED IN ACTION.—Sgt. C. R. Grandfield; Sgt. W. F. E. Thomas.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. R. S. Bell; Sgt. J. Davison; Sgt. G. F. Dunks; P/O. V. E. G. Goss; Sgt. G. W. G. Harding; P/O. H. Kelly; Sgt. R. R. Parry.

MISSING.—Flt. Sgt. R. T. Adams; Flt. Sgt. J. S. Aitken; Sgt. S. R. Ashton; Sgt. M. Bates; Sgt. W. P. Beare; Sgt. P. Bell; P/O. H. W. Blackford; Sgt. L. L. Brown; Sgt. F. N. Butterworth; Sgt. W. M. Cameron; P/O. S. A. Cheeseman; Sgt. G. Clelland; Sgt. D. G. Colley; Sgt. R. Colvin; Sgt. R. A. Coward; Sgt. A. C. Davie; Sgt. T. W. B. Emmott; P/O. J. Fisher; Sgt. R. J. Fraser; Sgt. E. Greenwood; Flt. Sgt. A. E. Groves; Sgt. R. A. Hale; Sgt. H. W. Hall; P/O. W. I. Hannam; Sgt. B. W. Harris; Sgt. R. J. C. Hazelton; Sgt. W. Henderson; Sgt. S. H. Heslop; Flt. Sgt. W. V. Hinds; Sgt. E. Hollows; Sgt. P. J. L. Hoyle; Sgt. A. Jones; Sgt. W. G. Kenneriey; Sgt. J. K. Knight; Sgt. S. Lang; Sgt. K. A. Lloyd; Flt. Sgt. G. T. Mantle; Act. P/O. W. S. Marshall; Sgt. J. Newton; Sgt. J. O. H. Nichols; P/O. A. F. O'Donnell; Sgt. A. W. Ragan; Flt. Lt. P. E. Rees; Sgt. W. P. Rixon; Sgt. A. B. Scanlan; Sgt. A. Scott; Flt. Sgt. W. B. Sharp; Sgt. S. A. G. Shaw; Sgt. A. Simpson; Sgt. R. F. Southern; F/O. N. J. Stabb; Sgt. R. W. Stewart; Sgt. N. Tart; Flt. Sgt. P. H. Thimblebee; Sgt. W. R. Wagstaff; Sgt. H. N. Wanostrocht; Sgt. N. E. Whiting; L.A/C. A. E. Wright; Sgt. P. W. Wrightling; P/O. F. H. Wood.

KILLED ON ACTIVE SERVICE.—Sgt. B. F. Adams; Sgt. K. J. Allwood; P/O. G. W. Ardley; F/O. F. Brannam; P/O. G. K. Chadwick; Sqn. Ldr. G. P. Christie, D.F.C. and bar; L.A/C. J. Ciarlo; Sgt. A. H. Cohen; Flt. Sgt. R. A. Coles; P/O. R. E. Corr; A/C.2 R. A. Coupland; Sgt. P. Crane; Cpl. K. E. V. Denyer; L.A/C. G. W. M. Duncan; L.A/C. F. Ellis; L.A/C. G. L. Emms; Sgt. A. C. Fisk; L.A/C. A. A. Ford; Sqn. Ldr. J. A. L. Fowler; L.A/C. G. W. Godfrey; Sgt. J. Greene; Sgt. W. D. Heap; Sqn Ldr. F. U. Hollins, A.F.C.; P/O. R. Jones; Sgt. A. Jordan; Sgt. E. G. Kinney; Sgt. S. J. Laws; L.A/C. C. S. Llewellyn; L.A/C. J. E. Maddick; Sgt. L. J. Mallows; P/O. R. H. Maunder; P/O. L. D. Rymer; W/O. K. B. W. Sims; Sgt. P. R. Swan; Sgt. C. Tilley; Sgt. J. White; Flt. Sgt. C. D. A. Whitehead; Sgt. J. Whitehead; Sgt. A. E. Willis; F/O. S. Le V. Wood, D.F.C.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. G. Coupland; Sgt. E. Hinchliffe; Sgt. R. E. Knights; L.A/C. L. L. Morgan.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. J. Bullock; A/C.1 J. S. Clarke; A/C.1 N. Debono; L.A/C. F. C. James; L.A/C. T. W. Middlemass; Sgt. J. L. Powell.

DIED ON ACTIVE SERVICE.—A/C.1 F. J. Bowers; Cpl. H. W. Burt; Cpl. A. Chester; A/C.2 G. A. Driver; Sgt. E. P. Fairgrieve; A/C.1 F. Fenger; Act. Cpl. S. S. Florence; Sgt. F. W. Galbraith; A/C.1 A. E. Hacker; A/C.2 K. A. Hyland; A/C.1 W. F. A. Jefford; A/C.2 J. B. Kennedy; A/C.1 R. H. Kenney; A/C.2 W. King; L.A/C. N. F. Kirk; L.A/C. K. McGee; A/C.2 P. G. Newman; L.A/C. J. W. Oats; Cpl. H. P. Price; A/C.2 R. J. Reid; Act. Cpl. H. Rushton; A/C.1 M. Seals; A/C.1 N. Shedden; Cpl. J. A. Sigston; A/C.1 M. Smith; Cpl. J. A. Spence; L.A/C. M. Thomas; A/C.2 G. W. C. Ugle; A/C.1 S. F. Wells.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A/CW. M. Callaghan.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. F. W. Dennis.

WOUNDED OR INJURED IN ACTION.—Sgt. C. Thorne.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. G. A. Arnold.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. E. Campbell; F/O. M. Hickey; F/O. R. L. Rogers.

MISSING.—Sgt. C. Brennan; Flt. Sgt. H. A. Ghinn; Sgt. E. Quirk; Sgt. A. L. Williams.

KILLED ON ACTIVE SERVICE.—Sgt. Dalton; Act. Sgt. C. J. Stewart; Sgt. R. Wilson.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Sgt. C. P. L. Brown; Flt. Sgt. I. T. H. Evans; Sgt. J. McM. Ferguson; Flt. Sgt. J. G. Holmes; Sgt. J. Howard; Sgt. B. P. Kopp; Flt. Sgt. P. L. Murphy; Sgt. C. B. Smith.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. H. Macauley.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. L. Thompson; Sgt. R. L. Vaughan.

MISSING, BELIEVED KILLED IN ACTION.—P/O. S. R. Balden; Flt. Sgt. J. R. Brennan; Sgt. R. G. Dusten; Flt. Sgt. N. C. Doehn; Flt. Sgt. R. B. Petersen; Sgt. L. C. Taylor.

MISSING.—Sgt. G. F. Alger; Flt. Sgt. J. W. Bell; Sgt. F. M. Cole; P/O. G. F. Cook; Sgt. W. McL. Crane; Flt. Sgt. J. W. Daubner; Sgt. W. J. Dickinson; P/O. D. Duxfield; P/O. A. R. R. Farley; Sgt. W. J. Harrell; Flt. Sgt. E. E. Kirby; Sgt. M. Knight; Sgt. D. McDonald; W/O. K. L. McDowell; Sgt. G. F. Macnutt; Sgt. J. J. Makarewigz; Sgt. W. Mitchell; Sgt. P. C. Omlyianowski; Flt. Sgt. P. P. A. Oneson; Flt. Sgt. F. Pikula; Sgt. G. M. Riches; Flt. Sgt. R. P. Shannon; Sgt. W. Thomson; Sgt. G. A. Tooth; Sgt. H. C. Watson; Sgt. W. H. Webster; P/O. M. W. Williams.

KILLED ON ACTIVE SERVICE.—Sgt. H. C. Beatty; Sgt. D. P. Carruthers; P/O. R. B. Cowell; P/O. O. A. Harris; Sgt. J. P. Hayes; Sgt. J. B. Kemp; P/O. J. K. McKechnie; Sgt. E. E. Mittell; Sgt. D. Palmason; L.A/C. A. W. Patmore; Sgt. R. W. Pearson; Sgt. C. F. Williams; Sgt. K. F. Yuill; P/O. H. G. Zavadowsky.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. R. McG. Taylor.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. J. A. Mulligan; Sgt. M. D. Woods.

DIED ON ACTIVE SERVICE.—L.A/C. G. J. Prince.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. H. H. Crawford.

MISSING.—Sgt. A. F. Bissell; Flt. Sgt. M. F. G. Fraser; Sgt. S. H. Mortimer; Flt. Sgt. A. I. Smith.

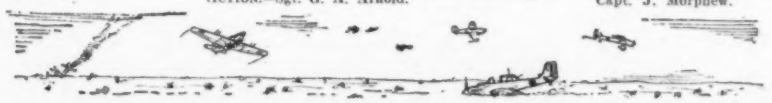
KILLED ON ACTIVE SERVICE.—Sgt. E. C. H. Doherty; Sgt. R. S. Pearce.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. D. W. Lockhart.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Lt. D. Paddon.

MISSING.—2/Lt. G. B. Calaghan; Capt. A. Duncan, D.F.C.

KILLED ON ACTIVE SERVICE.—2/Lt. Sutton; Major T. R. Theron, A.F.C.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Lt. G. A. Marshall; Capt. J. Morphew.